Russian Intonation:
A Perceptual Description

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It has never crossed my mind to choose between phonetics and linguistics. But traditionally the two disciplines are separate fields, which has caused a lot of misunderstanding on both sides. I became involved with this problem before I started my research. As initially some phoneticians considered my subject too specifically linguistic and some linguists the reverse, my intonation project would have fallen between the devil and the deep blue sea if Prof. A. Cohen had not been there to save it.

As I stepped into the field of phonetics, without leaving linguistics, it was J. 't Hart who made my fascination with intonation ever lasting. He offered me his assistance in many ways and he has always been an inexhaustible source of information.

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Volume 1

Part I

Chapter 1

Introduction

The research on Russian intonation reported in this book differs in many ways from the research described in the rich literature on the subject. A method of perceptual analysis/resynthesis, the stylization method, is applied to Russian. This method has so far only been used for Dutch and English, and recently for German.
The motive for the present study was the lack of perceptual evidence in most studies on Russian intonation. It was expected that by using the stylization method some problems of Russian intonation could be approached with the prospect of satisfactory results.
With the method of analysis/resynthesis, analysed fragments of speech can be made audible by resynthesis and compared with the original fragment. Furthermore, this method has the great advantage that problems under research can be shown in an audiovisual presentation, as will be explained in chapter 2. The present book reflects this advantage in its design. It consists of two parts in two volumes plus a cassette.

Volume 1
Part I: chapters 1 to 6.
Part II: chapters 7 and 8.

Volume 2
Part II, continued: chapters 9 and 10.

Part I. After the introduction in chapter 1 I will discuss the research method in chapter 2, as far as is necessary for a full understanding of subsequent chapters. In chapter 3 attention is paid to the perception of pitch phenomena, particularly in Russian. The chapter also describes the first attempt to make

a perceptual analysis of Russian intonation on the basis of a classification of pitch movements occurring in a fragment of two minutes of Russian speech. The initial result has been verified and modified on the basis of a larger corpus of fifteen minutes. The corpus provides the linguistic material used for the analysis of intonation in this book. Chapter 4 discusses five perception experiments devoted to pitch movements that were hard to classify. Chapter 5 describes in detail the perceptually relevant features of Russian pitch movements. The resulting overview of types of pitch accent with averaged phonetic data is presented in chapter 6.
Part II contains the corpus, described in chapters 7-10.
After an explanation of the representation chosen and notational conventions in chapter 7, the fragments of the corpus are commented upon in chapter 8. In volume 2 the texts of the corpus are given in chapter 9. Finally, in chapter 10 the actual so-called stylized pitch contours are presented. For the reader's convenience, the texts and contours are published as a separate volume: the comments on the corpus in the first volume can be studied along with the stylized pitch contours in the second volume. Pages are numbered consecutively in the two volumes.
Volume 2 is accompanied by a cassette with a sound demonstration of the original recordings of the corpus, the resynthesized versions of the original recordings and the stylizations. For an explanation of these terms see chapter 2. The cassette can be listened to while reading the pitch contours and the comments.
Apart from the publication of the corpus in stylized pitch contours and sound in part II, which in my opinion is the best illustration of the analysis, I have tried to give as many examples as necessary in part I to explain the items discussed. Most examples are taken from a film fragment which will not be commented upon in chapter 8. The text and the stylized pitch contours of this fragment are presented in volume 2 in order to show where the examples have been taken from. The original recording of the film fragment can also be found on the cassette.
The present research does not include a survey of the literature on Russian intonation, since this literature has recently been discussed in the works of Svetozarova (1982) and Keijsper (1983).

The aim of the research is to describe Russian intonation in terms of perceptually relevant pitch movements that combine to form complete stylized pitch contours. On the basis of a perceptual analysis, problems on the phonetic

and linguistic level can be solved. On the basis of the studies of Keijsper and Svetozarova issues for further research appeared to be the following:

1. The types of discretely different pitch movements in Russian.
2. The positions in which pitch movements occur.
3. The possible combinations of pitch movements.
4. The acceptable tolerance within pitch movement parameters.
5. The linguistic function of perceptually relevant pitch movements.

The present study is mainly devoted to the first issue.

List of operational definitions

Some of the terms used in my study are defined in the following list. All the terms will be introduced in the course of part I, but the reader may wish to consult the list at another moment. Where appropriate the reader is referred to the chapter or section in a chapter where a given term is dealt with.
The definitions of the terms must be read as being *limited to my description of pitch phenomena.* Terms are defined differently in various linguistic and/or phonetic "schools". The definitions listed below are therefore *operational* in the sense that they are strictly limited to the present study and are not intended to be a contribution to the solution of theoretical problems.

Close-copy stylizations
F_0 curves that have been reduced to the smallest possible number of discrete and invariant straight-line segments yielding perceptual equality with the original F_0 curves. Also: *stylization.*
Sections 2.3 and 2.3.6.

Configuration of pitch movements
A concatenation of pitch movements that as a whole is relevant for the perception of a certain type of pitch accent.

Declination
The tendency of F_0 to decline gradually in the course of an utterance.
Section 5.4.1.

Excursion
The size of an interval between the begin and end frequency of a pitch movement, usually expressed in semitones (ST).
Section 5.2.

Hertz
Unit of frequency: one hertz is one cycle per second, abbreviated as Hz.
Sections 2.3.3 and 5.2.2.

Intonation
Speech melody.
"The ensemble of pitch variations in the course of an utterance."
't Hart, Collier and Cohen (forthcoming).

Intonation pattern
A fixed concatenation of pitch accents.
Section 3.5.

Microintonation
Fluctuations in the fundamental frequency curve that are not intended by the speaker and are caused by physiological factors.
Section 2.3.7.

Perceptual equality
Melodic identity of pitch contours.
Section 2.3.6.

Perceptual equivalence
Melodic similarity of pitch contours.
Section 3.4.

Pitch accent
A (configuration of) pitch movement(s) lending perceptual prominence to a syllable.
Chapters 2, 3 and 5.

Pitch contour
A sequence of (configurations of) pitch movements occurring in the course of an utterance.
Chapter 2.

Pitch movement
A change in the fundamental frequency contributing to the melodic impression.
Chapters 2, 3 and 5.

Posttonic syllable(s)
The syllable(s) immediately following the pitch accented syllable.
Chapters 2 and 5.

Pretonic syllable(s)
The syllable(s) immediately preceding the pitch accented syllable.
Chapters 2 and 5.

Reference levels
High reference level: the highest end frequency occurring in the rising pitch movements of a given speaker.
Low reference level: the lowest end frequency occurring in the falling pitch movements of a given speaker.
Section 5.2.3.

Register
The melodic range of a given speaker between the high and the low reference level.
Pitch movements can be realized *high* or *low* in the register.
Section 5.2.1.

Reset
A jump upward or downward in the fundamental frequency course.
Also: *declination reset.*
Section 5.4.2.

Semitone
Logarithmic unit of frequency, abbreviated as ST.
Sections 2.3.3 and 5.2.2.

Slope
The steepness of a pitch movement as determined by the duration and the excursion of that movement, expressed in semitones per second, abbreviated as ST/s.
Section 5.4.

Stylized pitch contour
A pitch contour represented in close-copy stylizations.
Chapter 2.

Timing
The position in the accented syllable where the end frequency of a pitch movement is reached.
Early timing: the end frequency is reached near the vowel onset.
Late timing: the end frequency is reached much later than the vowel onset.
Section 5.3.

Tonic syllable
The prominent syllable in a word with pitch accent.
Chapters 2 and 5 and sections 5.5 and 5.6.

Type of pitch accent
A set of realizations of a pitch accent that are perceptually equivalent.
Section 3.3.

Zanos (= Russian for "set-up")
A small and usually steep rise in the pretonic syllable before a falling pitch accent.
Section 5.5.2.

Chapter 2

The stylization method

2.1 Introduction

In this study Russian intonation is analysed using the method of stylization, i.e. an approximation of the measured fundamental frequency (F_0) curve reduced to the simplest possible perceptually adequate form by means of straight lines. The main criterion in this stylization method is *perceptual equality* between the original fundamental frequency curve and the stylization of that F_0 curve.
The result of stylizing pitch phenomena in the way described in this chapter is a representation of Russian intonation in terms of *perceptually relevant pitch movements* which combine to form complete stylized contours.

2.2 The IPO approach

The explanation of the method in this chapter will not convey more technical information about hardware and software than is strictly necessary. Instead, I shall concentrate on how the equipment has been used during my research. The stylization method of analysing intonation uses the Linear Predictive Coding (LPC) analysis/resynthesis system.
A software package for the analysis and resynthesis of natural human speech on a minicomputer under VMS with ADC and DAC facilities contains all the speech processing programs necessary for my purpose (Vogten 1983). The speech signal is digitized and every 10 milliseconds analysed into thirteen parameters: voiced/unvoiced, gain, fundamental frequency and 10 coefficients from which 5 formants and their bandwidths are derived. These parameters are used for resynthesizing the speech signal and can be manipulated independently in such a way that perceptually irrelevant details can be deleted in

working interactively with the computer (see fig. 2.1). In the present research the main parameter manipulated is the F_0 (pitch) parameter. For more technical details the reader is referred to 't Hart et al. (1982).
The stylization method has been developed at the Institute for Perception

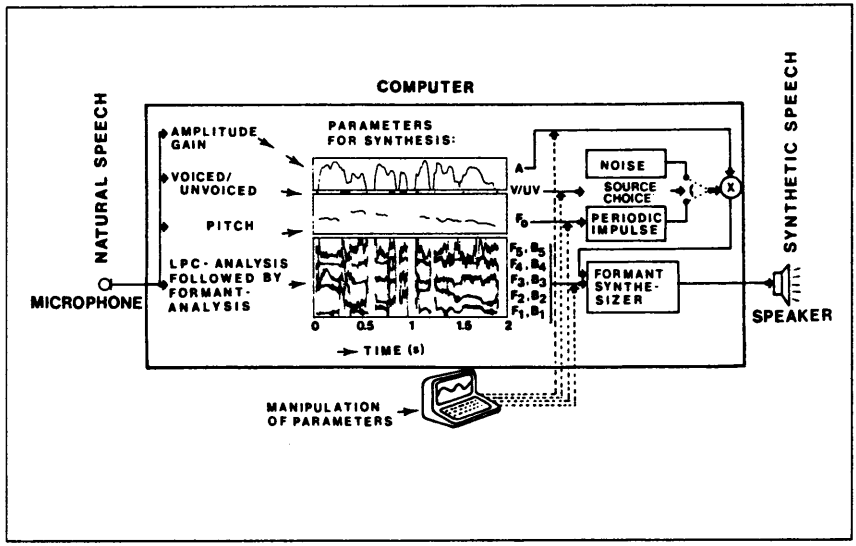

Figure 2.1: Diagram of the analysis/resynthesis system (S.G. Nooteboom and A. Cohen 1984)

Research (IPO) in Eindhoven, The Netherlands, by A. Cohen, R. Collier and J. 't Hart (e.g. 't Hart and Cohen 1973, 't Hart and Collier 1975). This so-called IPO approach to the analysis of intonation, known as the Dutch School of Intonation, is extensively discussed in 't Hart, Collier, Cohen (forthcoming).

2.3 From an original contour to a close-copy stylization

In this section some crucial steps in the process leading from original recorded speech materials to final stylizations will be discussed in detail. The process will be described from my own point of view as an experimenter, since a manual with directions for use which are other than purely technical does not exist. As we will see, stylizations are the result of experimental, interactive work. Every decision as to whether or not a given pitch movement is relevant for perception is primarily made by the experimenter. The acceptability of

stylizations is verifiable by native listeners in perception experiments (see section 2.4 below).

2.3.1 Input of linguistic material

The microphone recording on a Revox tape recorder, i.e. the analogue speech signal, is digitized and stored in the computer. After a quality check (the right loudness, peak level etc.) the experimenter segments the input into fragments. Parts where speakers talk simultaneously or produce noise other than speech are not analysed and are left out. The fragments usually have a duration which does not exceed 3 seconds. This is a convenient length for the analysis, as we will see in section 2.5. If possible, utterances are segmented into fragments at a boundary or, if a boundary does not occur within three seconds, at moments where there is "time enough" to cut off the running speech.
Summarizing, the analogue speech signal (the original microphone recording) is digitized and segmented into short fragments. The speech material is now ready for analysis.

2.3.2 The analysis of relevant parameters

After the speech signal is digitized, some programs are run for the analysis of the thirteen parameters mentioned in section 2.2. For the study of intonation the quintessence of the system used is that the parameters voiced/unvoiced, gain and fundamental frequency, can be manipulated *separately*, leaving the other parameters unchanged. Thus, changing pitch does not affect amplitude, voiced/unvoiced detection or formants. The great advantage is that manipulating parameters is a conscious process in the sense that no change in one parameter in the speech signal unintentionally "takes along" changes in other parameters. See fig. 2.1 in section 2.2.

2.3.3 The original F_0 curve displayed on the monitor

The actual work for the experimenter starts here.
After the analysis of the thirteen parameters a fragment is displayed on the monitor. The display shows gain, waveform, unvoiced parts and the F_0 (fundamental frequency) curve on a logarithmic scale, as demonstrated in fig. 2.2. On the x-axis the time scale is indicated in seconds. One dot in the fundamental frequency curve on the monitor represents 10 milliseconds.

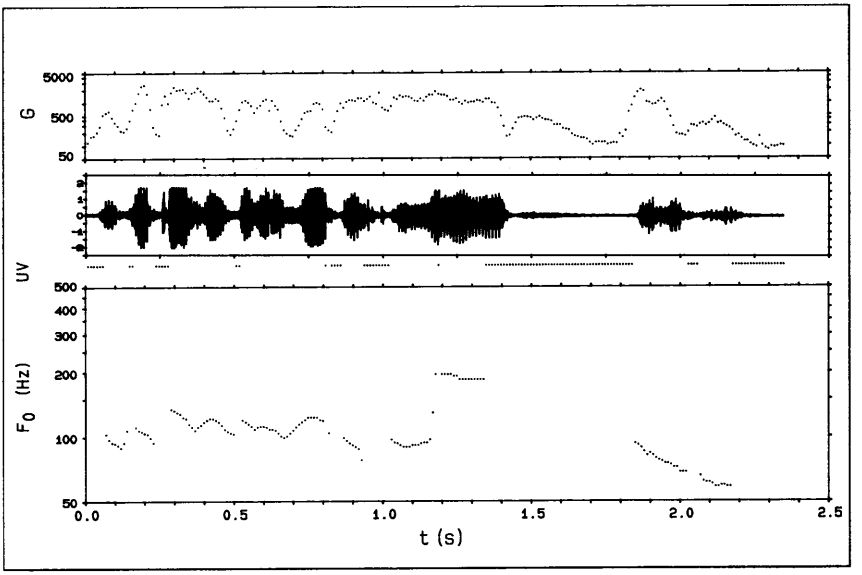

Figure 2.2: Gain, waveform, unvoiced indication (uv) and F_0 curve of an analysed speech fragment; one dot represents 10 milliseconds

On the y-axis values for pitch are displayed in hertz on a logarithmic frequency scale. The reasons for using a logarithmic scale are explained in section 5.2.2. For two given frequency values, f1 and f2, the ratio of these values can be calculated and converted into semitones with the following formula:

$$size = \frac{12}{log2}.log(f2/f1)$$

size = the size of a frequency interval in semitones;
f2 = the end frequency in hertz;
f1 = the begin frequency in hertz.

The fragment can be made audible by resynthesis and compared to the original fragment. There is a clearly audible difference in sound quality between the original version of the microphone recording and the analysed and resynthesized version.
Possible errors in the measurement of pitch or of voiced/unvoiced can now be corrected by comparing the original and the resynthesized versions.

2.3.4 Correction of errors

In figure 2.2 the whimsical, small fluctuations in the F_0 curve do not (yet) give an easily interpretable picture. First, all errors must be removed from the F_0 curve by listening and comparing the resynthesized with the original version. No differences in pitch should be audible between the two versions after correction of the errors. In figure 2.2, between 1.2 and 1.4s on the time scale, a measurement error of one octave can be observed. The "clean" contour, in which this error has been corrected, is shown in figure 2.3.

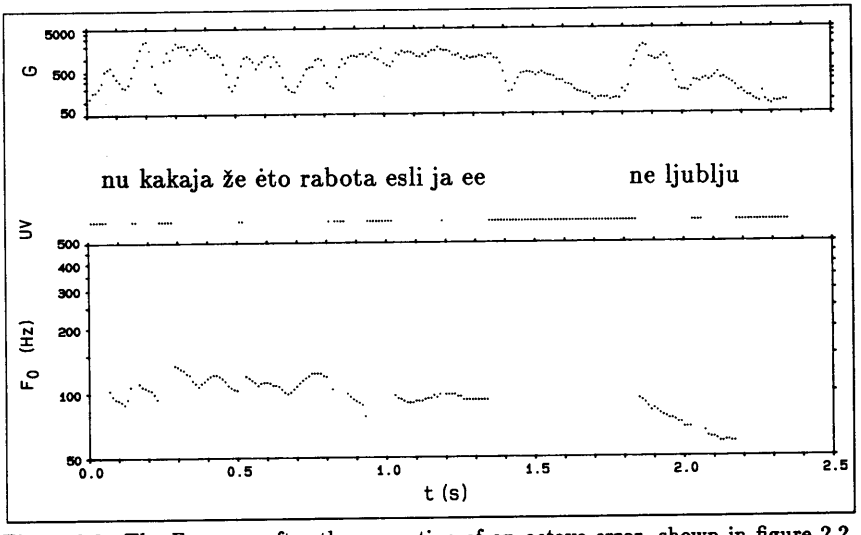

Figure 2.3: The F_0 curve after the correction of an octave error, shown in figure 2.2 between 1.2 and 1.4s

2.3.5 Voiced and unvoiced parts in the pitch contour

The program for the analysis of pitch phenomena detects voiced and unvoiced parts in the F_0 curve. However, it proved that many stretches were incorrectly detected as voiceless: a manual correction was necessary. Fricatives and affricates, in particular, needed frequent correction from unvoiced to voiced and sometimes the other way round. Unvoiced parts are absent in the F_0 curve and are indicated on the screen outside the picture of the pitch contour (see fig. 2.4). By comparing the gain and the F_0 curve we always know whether an interruption in the contour is caused by silence or by an unvoiced part. The computer software allows us to make unvoiced parts voiced and vice versa.

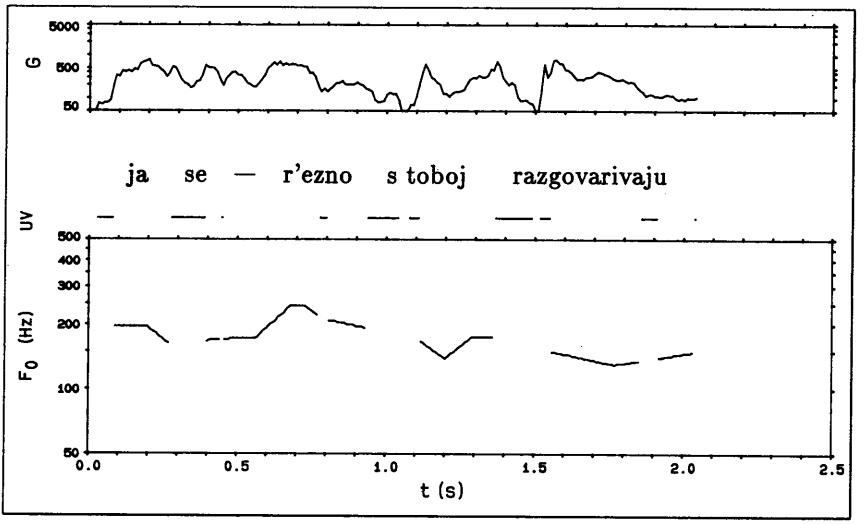

Figure 2.4: Voiced/unvoiced decision

2.3.6 Stylizing F_0 curves by means of straight-line segments

After the correction of errors we have a basis for further stylization. The fascinating work of stylizing pitch phenomena begins at this point. The process of stylizing ultimately results in a *close-copy stylization* in the sense of De Pijper (1983) (see below).

The way in which the actual work has to be carried out will be discussed in this section. Some observations made during the stylizing process will be described in section 2.5. In working interactively with the computer the experimenter reduces fundamental frequency curves in the pitch domain on a logarithmic scale (see also section 5.2.2) to the smallest number of *straight-line segments* which will still yield *perceptual equality* with the original F_0 curve. This means that all pitch movements in a final stylization are *perceptually relevant* and cannot be reduced further: no movement can be omitted without introducing a perceptual difference with the original F_0 curve while listening very critically. This type of stylization is introduced by De Pijper and defined as "(...) stylizations, where virtually no perceptual differences appear to exist between stylized pitch contour and original fundamental frequency curve and which are as economical as possible in terms of the number of pitch movements needed" (de Pijper 1983: 20). Straight lines connect the moments in the F_0 curve where pitch switches into another direction (see fig. 2.5). Though

the criterion in making close-copy stylizations has to be *perceptual equality* between original and close-copy stylization, more than one close-copy stylization of an original may exist. Another experimenter may make a close copy that differs slightly from mine, but which is also perceptually equal to the original. Straight lines can be drawn step by step, i.e. in steps of ten milliseconds

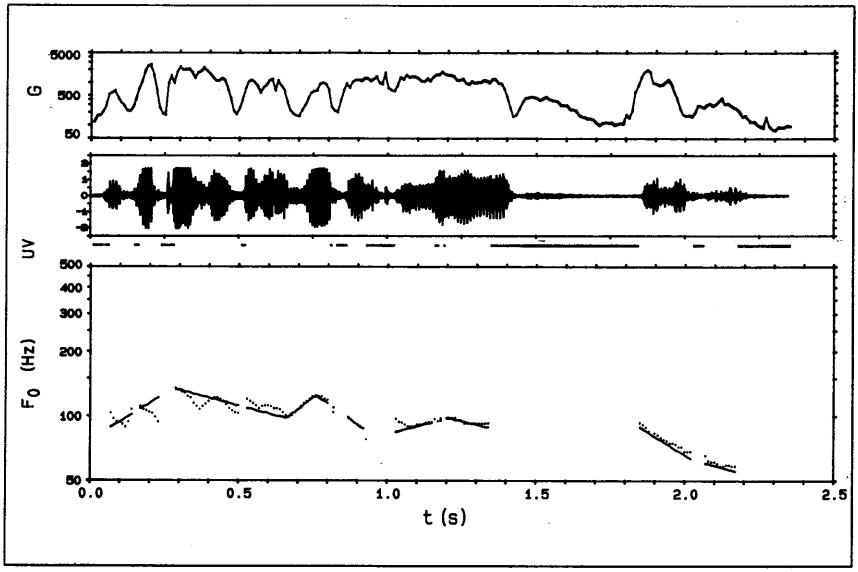

Figure 2.5: Gain, waveform, original, corrected F_0 curve (dotted line) and close-copy stylization (solid line) of a speech fragment

forward or backward. Stretches to be changed in pitch can be indicated by moving the graphic cursor (with x-position (time) and y-position (F_0)) on the screen over the F_0 curve. The begin and end values between which an interpolation in pitch is to be made (see fig. 2.6) must be defined with the cursor.

Thus, by defining the begin and end points of an F_0 line, we draw a new line over the original F_0 curve with the cursor. The old and new lines remain visible on the screen as long as we do not clear it (see fig. 2.7).

With the cursor we also indicate the beginning and length of a stretch to be resynthesized and spoken. Any step, stretch or fragment can be made audible and be compared with the original F_0 curve of the same part of the utterance. In this way we can listen to how an interpolated stretch sounds and how it "fits" melodically into the fragment. Finally, after the whole fragment has

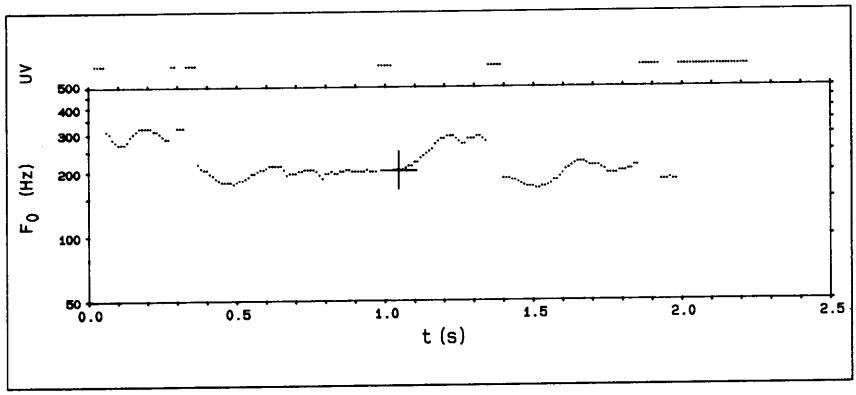

Figure 2.6: The graphic cursor on the screen

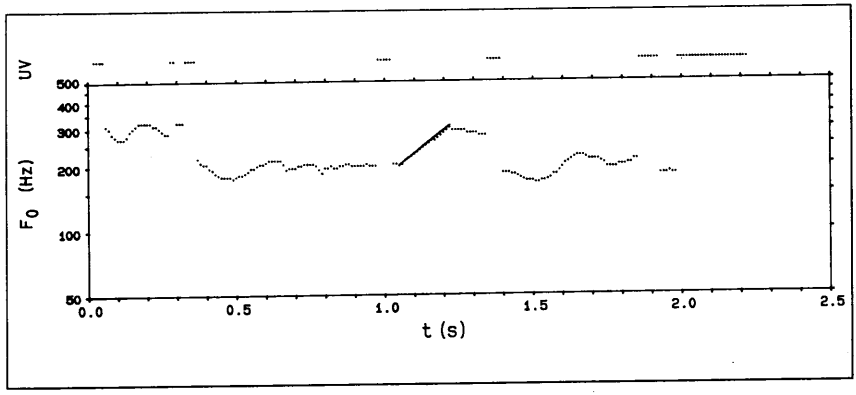

Figure 2.7: Interpolation of a stretch in the F_0 curve

been stylized, the original and the stylized contours can be compared and evaluated by the experimenter. On the screen the two contours can be drawn one on top of the other on exactly the same time scale with the (untouched) gain and amplitude. Only pitch has been changed, and what we see now are the straight-line segments through the original "round" movements (figure 2.8). The original F_0 curve with all its *round* forms stylized into a minimum of *straight*-line segments? At first sight this seems unbelievable, and it usually *is* to someone who is not familiar with the method and has never heard its results. As already mentioned, the main criterion of the stylization method is *perceptual equality* between the original F_0 curve and the stylization. An F_0 curve showing a round line in the original version that can be replaced by a straight-line segment in the stylization *without audible difference* enables us

to describe pitch movements as economically as possible. For we do not only replace *one* round F_0 curve by *one* straight-line segment. We may reduce *a number* of round F_0 curves to *one* straight-line segment if only the perceptual criterion is maintained. The number of pitch movements that are relevant for perception is thus reduced to a minimum. From experience we know that human ears do not hear a difference between "round" and "straight" speech. It has sometimes been suggested by colleagues unfamiliar with the IPO styl-

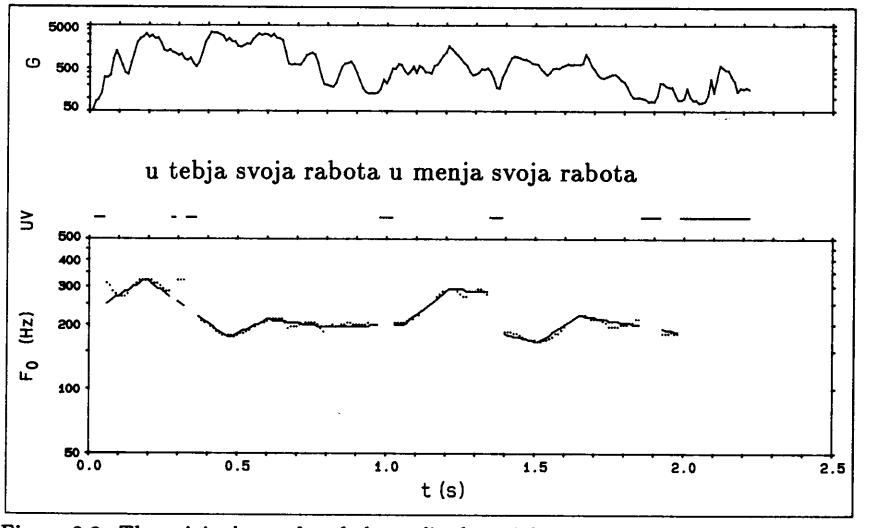

Figure 2.8: The original round and the stylized straight movements one on top of the other

ization method that pitch should be stylized into parabolas instead of into straight lines: it was thought that this would sound more natural. But this is not the case: straight-line segments sound fully acceptable. With sound demonstrations of stylizations I could always convince my sceptical audience that straight-line segments do not sound "angular". It is for this reason, among others, that the corpus in part II comes with a cassette.

2.3.7 Microintonation

Fluctuations in the F_0 curve of natural speech which are not intended by the speaker, but are involuntary, being caused by a combination of physiological factors, are indicated by the term *microintonation*. In the corpus the fluctuations caused by microintonation are retained in the stylized pitch contours

only if it would sound perceptually unacceptable to leave them out. But in the present study microintonation is not commented upon. On a higher level of abstraction microintonation need not be retained in the stylized representation of pitch contours. For more detailed information about microintonation the reader is referred to 't Hart, Collier and Cohen (forthcoming).

2.4 Evaluation and verification of stylizations

As already mentioned, close-copy stylizations can be verified at any moment by auditive comparison of the resynthesized versions of the original contour with the stylized version. A resynthesized stretch can be produced instantly and the original and stylized versions can be listened to immediately, one after the other. The minimum duration of a stretch is 10 milliseconds. Subsequent or previous stretches of any duration in milliseconds can be made audible from any point onward.
By listening and comparing a short stretch of 20 or 30 ms (10 ms is too short a duration for comparison) it is easy to determine the exact highest or lowest point of a F_0 change. If a stylized straight-line segment sounds acceptable when compared with the original version, it is important to listen to how the stretch fits into the whole fragment melodically. A short stylized stretch of 50 ms sometimes sounds fine compared with the original version, whereas in the whole fragment of, for instance, 3 seconds a perceptually unacceptable difference is audible. The reverse may also occur, but that is not perceptually relevant as long as we are dealing with stylizing longer excerpts of running natural speech and not with isolated sounds.
If a stylization at the beginning or the end of a fragment does not sound acceptable, it must be compared with the preceding and/or following fragments: fragments are not always segmented at a boundary (see section 2.3.1). Moreover, it is almost impossible to stylize isolated F_0 curves, since the melodic context strongly influences the perception of pitch movements.
My stylizations have been verified in informal perception experiments with trained listeners, who did not necessarily know Russian. This is a means of control for the experimenter and a good preparation for further experiments with native subjects. With the help of very experienced ears, more specifically those of J. 't Hart, contours which were hard to stylize have improved considerably.
Close-copy stylizations which are accepted by the experienced experimenter and by non-native and native trained listeners hardly need further verifi-

cation. My non-native and native listeners were all experts in the field of prosody. Though stylizations slightly different from the original version do occur, trained non-native and native listeners have waved the significance of these differences aside as being too subtle to pay attention to. The stylizations accepted by specialists have never been rejected by other listeners.

2.5 Aspects of stylizing F_0 curves in Russian

The title of this section must be read as being limited to those pitch movements which occur in the analysed corpus. Some experiences will be described that are strictly personal. These experiences do not pretend to be more than a report on what was observed during the process of stylizing F_0 curves in Russian.

2.5.1 Finding the pitch accents

In the stylization method used for my purpose the only parameter I have changed, apart from the voiced/unvoiced detection, is F_0. In stylizing there are two activities: audiovisual stylizing (with the eye, with analytical and broad listening and comparing) and visual stylizing (with the eye, without listening), not necessarily in this order. Visual stylizing requires experience, but it can be a help in stylizing F_0 curves which connect accent-lending pitch movements if the former show a very capricious picture that is hard to interpret. The first task is to establish where pitch accents in a fragment of speech occur, by listening repeatedly to a whole fragment. Sometimes a syllable becomes prominent if a small movement that seems to be larger than the adjacent movements which have been smoothed out is stylized into a rising and/or falling movement. On the other hand, a pitch accent that has only a small movement may be wiped.
In order to verify whether an accent is indeed a *pitch* accent, the movement(s) realized in the (pre-/post-) tonic syllable(s) can be removed in doubtful cases. If the accent is still perceived, another prosodic cue (vowel length, loudness, rhythm, vowel quality) and/or linguistic cue (in the structure of an utterance) or some combination of these cues lends prominence. But "(...)there are reasons for believing that pitch is the one most heavily relied on. When conditions are arranged artificially to pit one cue against another, pitch usually carries the day against length and loudness" (Bolinger 1986: 21-22). Experiments carried out by 't Hart (1969) and Van Katwijk (1974) show the same and

confirm the strong position of pitch as a first cue for the perception of prominence.
The verification of whether accents are *pitch* accents must be carried out very carefully, since acoustically a (configuration of) perceptually relevant pitch movement(s) may occur at various places with respect to the accented syllable: acoustically there is not necessarily a one-to-one relationship between a syllable with pitch accent and a pitch movement. One pitch movement or a configuration of pitch movements may be extended over more than one syllable, including the accented one. Perceptually, however, in such cases there can be a one-to-one relationship between a syllable with pitch accent and a pitch movement. The sequence of syllables, including the accented syllable, covered by one pitch movement is then perceived as if the pitch movement "fills" only the accented syllable. It is amazing how few stylized pitch movements are sufficient for one fragment, while other fragments require many of them. The number of pitch movements does not always seem to correspond to our auditive imagination. Thus, acoustics and perception do not necessarily coincide. This issue is discussed in detail in chapter 3.
In order to verify whether we are dealing with a *pitch* accent, especially if one pitch movement covers a sequence of three syllables the accented syllable of which is the middle one, the movement can be manipulated and shifted backward or forward with respect to the accented syllable and compared with the original version. If the accent is still perceived in the same syllable when the pitch movement is elsewhere, another (combination of) cue(s) is responsible for the perception of prominence. In the example in figure 2.9 the pitch accent in the word *menja* (solid line) has been shifted to a pitch accent in the word *ljubiš'* (dotted line).
In summary, the process of determining pitch accents can be verified at any moment by listening and comparing the stylization with the original version and, if necessary, by manipulating pitch movements.

2.5.2 Straightening originally curved movements

The exact location of a point where pitch switches into another direction is very important. Placing the perceptually relevant turning point too late or too early may change the pitch movement into another type of pitch movement. By means of a few examples I will demonstrate how straightening the wrong side of an originally whimsical curved movement may result in a perceptually unacceptable placement of a turning point. A curved rising pitch

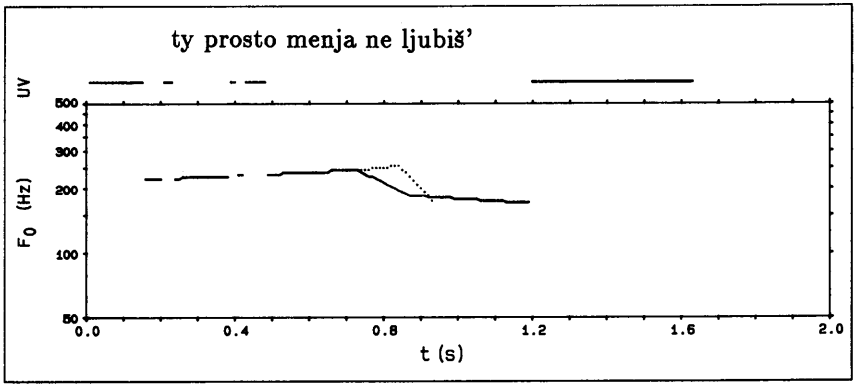

Figure 2.9: Manipulation of a pitch accent in *menja* (solid line) to a pitch accent in *ljubiš'* (dotted line)

movement can be stylized by taking the lowest and highest points and interpolating between them (fig. 2.10).
In figure 2.10 we see that parts of the curve are situated to the right of the straight line and parts to the left. In the case of small movements, where the highest point is reached late in the accented syllable (see section 5.3), this stylization is mostly perceptually acceptable. However, things are not that simple.
For movements with a large excursion (see chapter 4) there is a perceptual

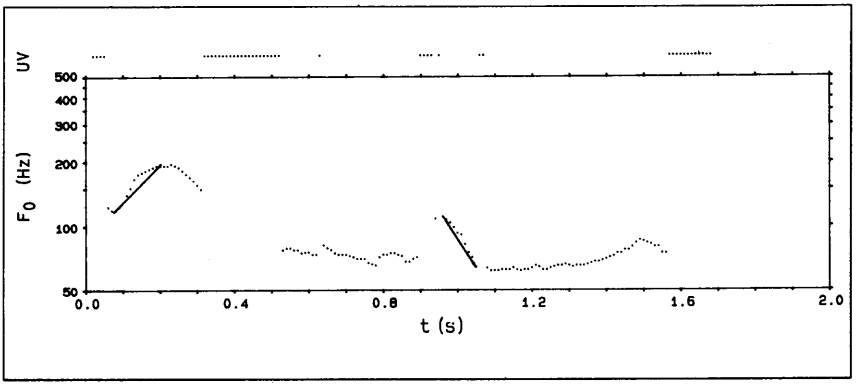

Figure 2.10: Stylizing curved pitch movements

difference between movements which reach the highest point early and those which reach the highest point late in the accented vowel, as well as between the different ways in which this point can be reached, namely by a steep or by

a gradual rising movement. For these movements the curves must be stylized in a very subtle way. Generally speaking, for steep movements reaching the highest point early in the accented vowel the outside of the highest part of the curve must be taken; for gradual movements reaching the highest point late in the accented vowel the inside of the lowest part of the curve must be taken (fig. 2.11).
These are only indications. Individual cases may deviate from the general.

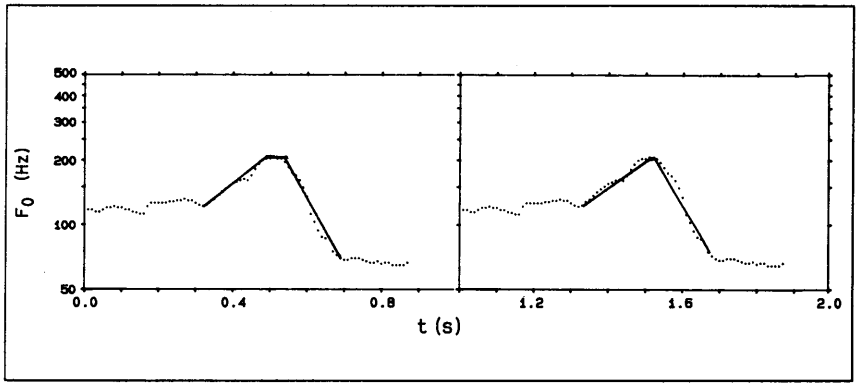

Figure 2.11: Stylizing the outside and inside of curved movements

The visual F_0 curve does not give information about which of the two perceptually different movements we are confronted with. Stylizing is sometimes a question of trial and error, but we can always control the process by listening and comparing.
The perceptually different stylizations of curved rising movements are presented in fig. 2.12. The same phenomenon has been observed for falling movements: some types of pitch movements can be stylized systematically in the same way.

2.5.3 The plateau in configurations of pitch movements

In close-copy stylizations the fundamental frequency curves are reduced to the smallest number of straight-line segments. All straight-line segments are perceptually relevant. In configurations of rising and falling pitch movements the perceptually relevant part sometimes consists of two segments (see fig. 2.13). In most cases the plateau in the highest or lowest part of the tonic syllable cannot be left out or "stylized away" without introducing clearly audible differences.

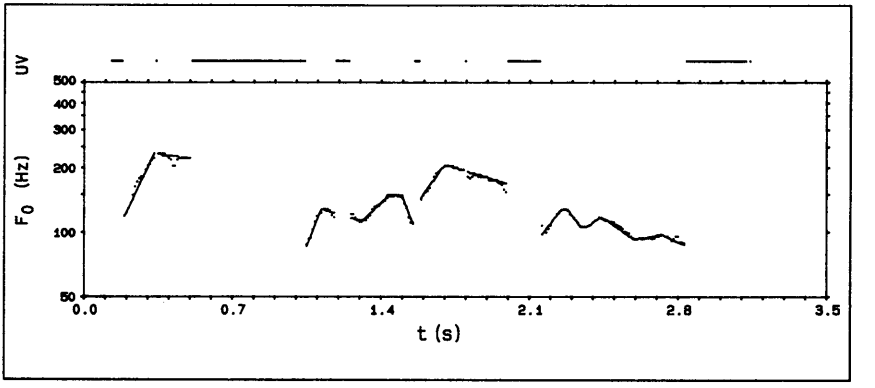

Figure 2.12: Some possible stylizations of F_0 curves

The plateau is the stylized upper or lower part of a curve in the original pitch contour. The plateau is usually observed if the pitch movement is completed *early* in the accented vowel. In that case, the highest or lowest point is reached at the vowel onset and the same pitch level is held for some tens of milliseconds.

For some types of Russian pitch accent the plateau is a perceptually relevant part of the configuration (see chapter 6). I have made the plateau where it was perceptually unacceptable to stylize the movement without the plateau, by making the rise higher or the fall lower.

The plateau is *not* acceptable if the movement is completed *late* in the ac-

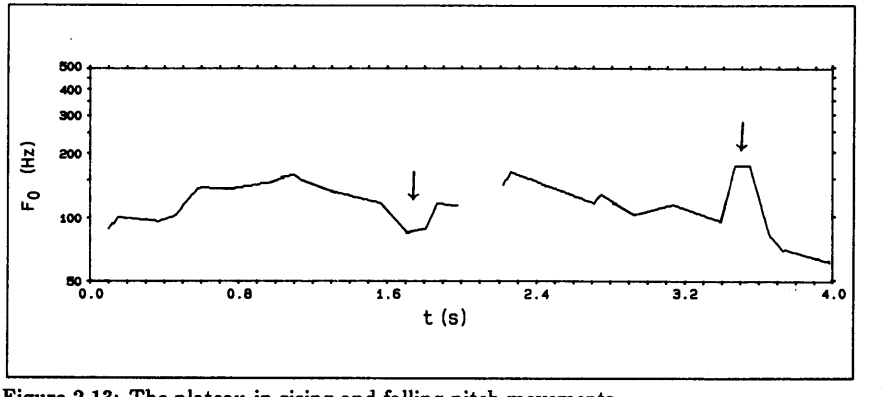

Figure 2.13: The plateau in rising and falling pitch movements

cented vowel. The result usually sounds too high (with rises) or too low (with falls) as compared with the original version. A movement which is completed

late in the accented syllable and continues for some tens of milliseconds on the same pitch level will be perceived as slightly rising or, respectively, falling, depending on the duration of that level tone and subsequent posttonic movements.

2.5.4 The duration of a straight-line segment

The duration of a connecting non-prominence lending pitch movement in between pitch accents varies. It is easily perceived when a straight-line segment is too long: in the resynthesis the *speaker* is suddenly a *singer*, or the segment sounds unnatural. The unnaturalness can be caused by the absence of microintonation (see section 2.3.7) which has incorrectly been stylized away, or by a pitch accent which has been omitted or is maybe only small. This can sometimes be corrected by finding another begin or end frequency for the pretonic and posttonic parts, respectively.
In figure 2.14 the segment indicated in the first contour (dotted) is too long and sounds unacceptable; it is corrected in the second contour (solid). The correction has been made by listening and comparing the original with new stylizations until the segment sounds perceptually acceptable.
Again, these are only indications.

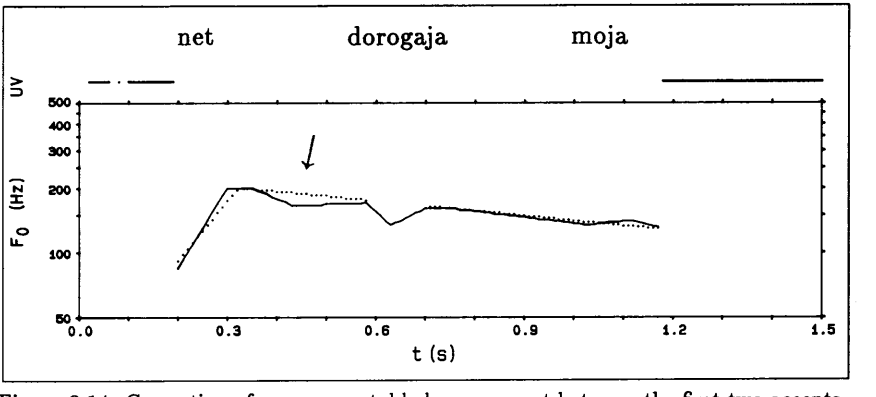

Figure 2.14: Correction of an unacceptable long segment between the first two accents

The duration of a gradual pitch movement must not be too long, but there are also certain perceptual limits to the steepness of slope in pitch movements. Though movements have been found with a steepness of up to 190 semitones per second (see chapter 6), which is extremely steep, there is a point where a voice breaks if the movement is stylized too steeply.

Declination reset is a different matter (see section 5.4.2). This is a jump in F_0 in an utterance upward or downward. Such jumps cannot be described as *pitch movements* and, consequently, no degrees of slope for such jumps can be given.

Chapter 3

Classifying pitch movements into types

3.1 Introduction

Chapter 3 describes the process of classifying configurations of perceptually relevant pitch movements. First, the discrepancy between acoustics and perception will be discussed by explaining how acoustically different pitch movements can be perceived as realizations of one type of pitch accent. Next, the way in which (configurations of) pitch movements are grouped together into types of pitch accent on the basis of *perceptual equivalence* will be considered.

3.2 Acoustics vs. perception: you do not hear what you see

The title of this section reflects exactly what we are confronted with in the process of stylizing F_0 curves: the discrepancy between acoustics and perception, i.e. differences between the acoustic representation and the perception of the speech signal. Pitch movements can be perceived as if they occur at another pitch level, at another position in the speech signal, earlier or later, than the actual acoustic information shows. For example, a pitch movement that is perceived as falling during the accented vowel, can acoustically already have been completed before the actual onset of the accented vowel. Also, a perceptually relevant pitch movement can cover more than one syllable; this occurs more often than one might expect.
Furthermore, it is sometimes very difficult to hear whether pitch is rising or falling in the accented vowel. Looking at the fundamental frequency curve to see whether it is a rise or a fall gives only acoustic, not perceptual evidence.

As has been discussed in section 2.5.1, F_0 curves can be manipulated and compared with the original version in order to find out whether the stylization has been made perceptually correct.
If a movement is acoustically not situated in the accented syllable where we perceive it, then how do we visually represent the perceptually relevant pitch movement in that syllable? Two different types of information must be given: the perceptually relevant pitch movement and the position of that movement with respect to the accented syllable. If only the perceptual information is presented, we lack the information about where the perceptually relevant pitch movement is situated with respect to the accented syllable.
Some examples will be given that are relevant for a better understanding of the stylized pitch contours presented in part II.
The bold line in the examples indicates the whole accented syllable, the small perpendicular dash on the bold line points to the position of the vowel onset in the accented syllable (fig. 3.1). The accented syllables are indicated in italics.
In figure 3.1 one falling movement in the word *chorošo* covers two pretonic syl-

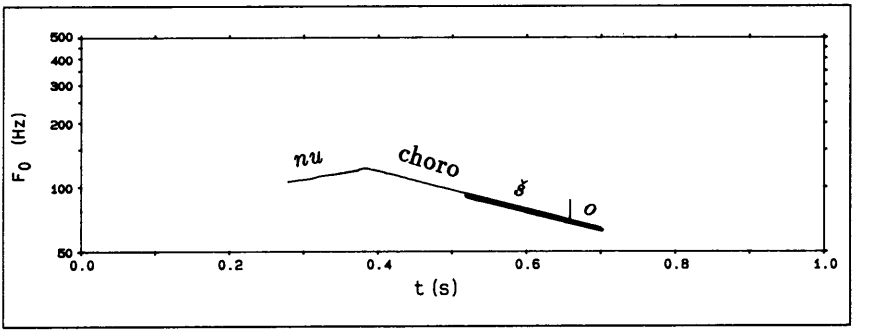

Figure 3.1: A falling pitch movement in the word *chorošo*

lables and the final accented syllable. The vowel onset of the accented syllable is situated low at the end of the falling movement, but the entire movement is perceived as being situated in the accented syllable. The perceptually relevant pitch movement is thus the entire falling movement. Note that if by manipulating F_0 the whole movement is shifted forward in time in such a way that the perceptually relevant pitch movement now takes place only within the tonic syllable, the manipulation affects timing (see section 5.3) and thus the perception of the movement.
In fig. 3.2 a rising movement in the word *voobšče* covers two pretonic syllables. The position of the vowel onset is at the beginning of the plateau at the

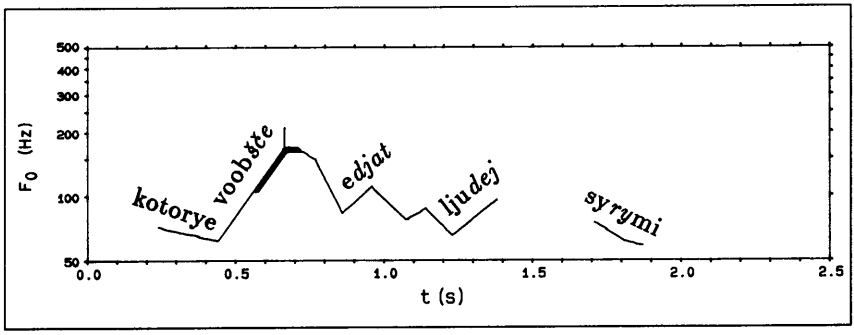

Figure 3.2: A rising pitch movement in the word *voobšče*

highest point of the rise. The perceptually relevant part is a configuration of the rising movement and the plateau.
In the first example in fig. 3.3 the accented syllable in *menja* is only slightly higher than the pretonic syllables. Yet a rising pitch movement is perceived: pitch falls immediately after the accent and the pretonic syllables are realized at a high level.
In the second example the fall is already completed at the vowel onset in the accented syllable in *ljubiš'*. Pitch continues on the same level. The perceptually relevant part is the pretonic falling pitch movement and the plateau, though in the accented and posttonic syllables pitch is level.
Figures 3.4 and 3.5 illustrate another falling movement. In these cases the falling movement is completed at the end of the accented syllable. In both examples the fall is preceded by a smaller (fig. 3.4) or a larger (fig. 3.5) rising movement in the accented syllable.
The examples have illustrated the discrepancy between acoustics and perception. For a classification of pitch movements based on melodic similarity it is important to be aware of the phenomenon that there is not necessarily a visual similarity between melodically similar pitch movements.

3.3 Classifying pitch movements on the basis of melodic similarity

In the process leading from an original tape recording towards a perceptual description of Russian intonation a first stage has been the finding of the perceptually relevant pitch movements (section 2.5.1) in the corpus. The next stage then involves finding *types* of (configurations of) perceptually relevant

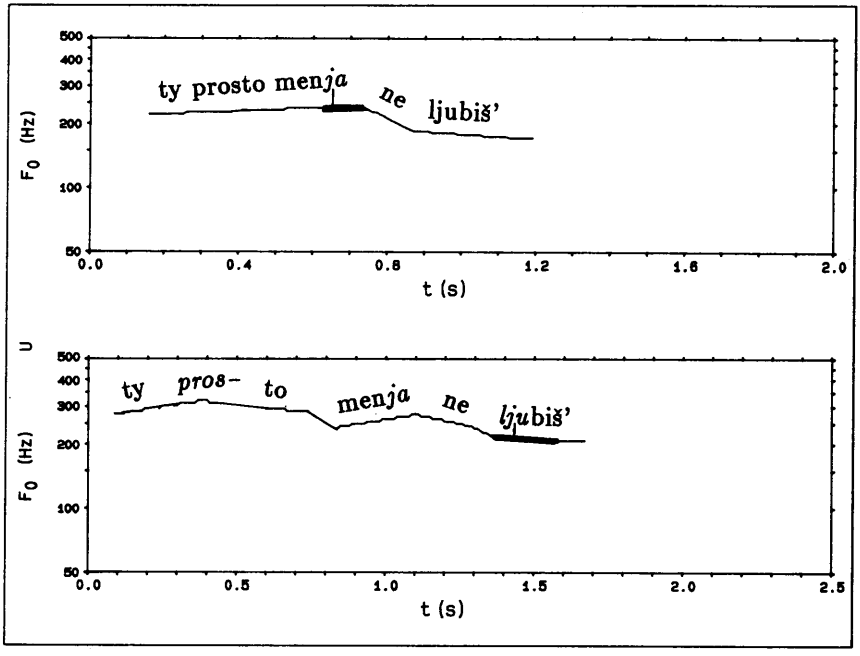

Figure 3.3: A level pitch movement in the words *menja* and *ljubiš'*

pitch movement on the basis of melodic similarity: all (configurations of) perceptually relevant pitch movements must be compared with one another and be classified into discretely different types of pitch accent. The final result of the classification is an overview which contains averaged phonetic specifications of all the types of pitch accent that were found to exist. This overview will be presented in chapter 6.

For a classification into types it is not sufficient to group together pitch movements with more or less the same phonetic features. For the reasons mentioned in section 3.2 a type can only be described in terms of phonetic features after it has been determined perceptually, and not the other way round. A phonetic description of perceptually relevant pitch movements is therefore not a reliable tool in the classification task: before a type has been determined we do not yet know which phonetic features are responsible for the perception of melodic similarity and to what extent they affect this perception. The perceptual criterion always comes first, also in classifying perceptually relevant pitch movements.

As we have seen in section 2.3.6, in assessing perception it is important to

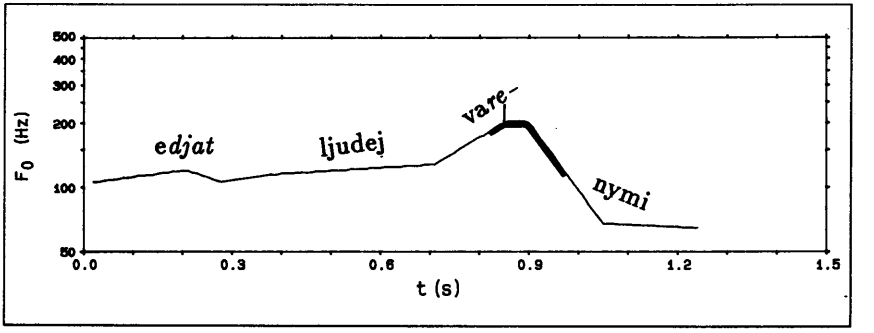

Figure 3.4: A rising-falling movement in *varenymi*

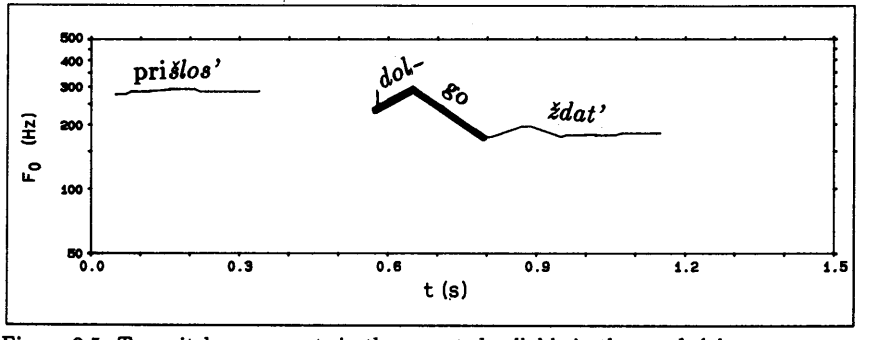

Figure 3.5: Two pitch movements in the accented syllable in the word *dolgo*

listen to pitch movements in an isolated position as well as in a longer fragment. The same holds true for the classification of pitch accents. By isolating pitch movements, perceptually relevant pretonic and/or posttonic movements that are part of the configuration of a given type of pitch accent may have been cut off; in a longer fragment movements are more difficult to recognize, let alone classify. In the process of classification, movements were listened to and compared with one another from both perspectives: in isolation and in context. In order to make the classification, isolated pitch movements and movements in context were made accessible in the computer for listening to in random order and they were also recorded on tape.

In my view, the classification of pitch movements must start with a purely auditive activity. I therefore avoided the view that "what I see is what I hear". Afterwards, displaying on the monitor what I had been classifying was sometimes a revealing experience.

The classification task was carried out as follows. Similar (configurations of)

movements in an excerpt from a single speaker were sorted. Rising and falling pitch movements with clearly audible differences were separated from one another, similar (configurations of) movements were grouped together, listened to and compared.
After a first rough division, further subdivisions into melodically similar groups were made: movements that did not fit melodically into a group after the first classification were compared with other groups or put into a separate group. Initially, the number of groups increased and movements travelled from one group to another until all perceptually relevant pitch movements had fallen into place.
The perceptually relevant pitch movements were sorted over a long period, because groups had to be listened to regularly with fresh ears every few weeks and months. If after listening analytically to one group all the (configurations of) movements in that group did sound melodically similar, the perceptually relevant pitch movements were considered to be realizations of a discrete type of pitch accent and to be *perceptually equivalent* (see section 3.4).
The process just described had to be repeated for the excerpts from all speakers. The groups that were found to exist for one speaker could then be compared with the groups for other speakers. Some perceptually relevant pitch movements did not occur in all excerpts.
Finally, groups for all speakers were matched.
The identified groups could now be described in terms of *types of pitch accent* and phonetic specifications could be given. From the process of stylizing I knew that a description of merely the tonic part, even if the whole movement was situated in the accented syllable, does not uniquely identify a type: the tonic part may be identical in different types of pitch accent. Other features, in the pretonic and/or posttonic part, demanded their share in the perceptual description. This phenomenon has already been touched upon in section 3.2. Moreover, phonetic features that are decisive for the recognition of one type of pitch accent can be subordinated to other features in another type.
A first experience in classifying pitch movements is described in detail in section 3.5.
My classification has been verified in informal pretests with non-native and native trained listeners, and in formal perception experiments with native subjects. The formal experiments are described in chapter 4.

3.4 Perceptual equivalence

Configurations of perceptually relevant pitch movements which have been classified into discretely different types of pitch accent are *perceptually equivalent* within each of these types. Differences between realizations of pitch accents are always audible, but such realizations can be recognized as belonging to one type; in the same way the taste of coffee may vary, but the taste is still that of coffee and not, for example, of tea. How then to define the limits of perceptual tolerance, which makes two configurations belong to the same type or to different types?

Whereas perceptual *equality* means that there is *no audible difference at all* between two configurations of movements, the perceptual *equivalence* between two configurations of movements is perceived on a higher level of abstraction. If native speakers have to indicate the melodic similarity between two configurations, they may apply two criteria:

1. The perception of the melody.
2. The function of the perceived melody in the given context.

How do we know which criterion has been switched on? The linguistic consciousness of native speakers cannot be excluded, whatever we ask them to listen to.

If the focus is too much on melody, all movements will be perceived as different. If the focus is too much on functional aspects, there is a phase between the description of perceptually relevant pitch movements and the description of functions of types of pitch movement that has been omitted: the classification into *types* of pitch accent. A type of pitch accent can have various functions in different contexts, e.g. "question" and "continuation". On the other hand, different types of pitch accent can be used in e.g. a "question".

Given the two criteria *melody* and *contextual function*, two movements can be

1. melodically similar and functionally the same;
2. melodically similar, but functionally not the same;
3. melodically dissimilar, but functionally the same;
4. melodically dissimilar and functionally not the same.

If the question is whether two movements are melodically equivalent, the native speaker will say "yes" in case no. 1 and "no" in case no. 4, but he may hesitate in cases no. 2 and no. 3.

My classification is based upon melodic similarity, i.e. the borderline is in between nos. 1 and 2 on the one hand, and nos. 3 and 4 on the other. This approach is based upon the opinion that the linguistic description should start

from the form (nos. 1 and 2). The present study is not concerned with the functional side of the problem. But it can serve as a basis for future research in this area, in the following way.

For all examples of one type of pitch accent in the corpus, the contextual functions of that type should be examined in order to determine whether these functions can be summarized into one *meaning*. If that is the case, the contextual functions found are *interpretations* of that meaning.

As to case no. 3, I doubt whether such cases really exist. The question of whether descriptions saying that no. 3 does exist are correct should be investigated, i.e. whether the presumption of functional identity can be maintained if several examples are examined.

Another matter that has to be discussed in the context of classifying pitch movements is defining *standard* pitch movements. Making standard movements can be useful for computerized text-to-speech systems, or for the teaching of intonation. In a standardized description of pitch movements, perceptually equivalent movements are modified to such an extent that only one prototype results.

In my overview I have indicated the averaged values for every speaker of the corpus separately and for all speakers together; also, between brackets the maximum and minimum values (the limits of perceptual tolerance) of phonetic features are given for every type of pitch accent. These values are stated in chapter 6. As long as the functional side of Russian intonation has not been described satisfactorily, I regard it as premature to define prototypes.

For example, in a sequence of rising pitch accents of one type it is linguistically

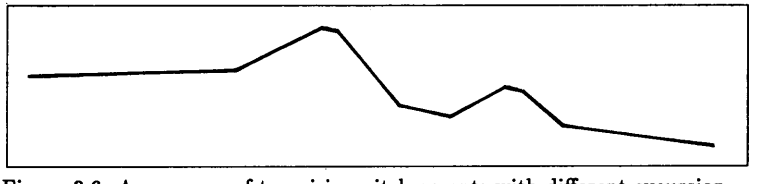

Figure 3.6: A sequence of two rising pitch accents with different excursion

relevant which accents are "subordinated" to others. In the original recording of the utterance "u vas cholodnoe pivo?" (do you have cold beer?) two rising pitch accents occur: in "cho*lod*noe" (cold) and in "*pi*vo" (beer)(the accented syllable is indicated in italics). The first rise has a larger excursion than the second rise (see figure 3.6). The speaker of this utterance asks whether there is something cold to drink, preferably beer. If the question were about the temperature of the beer, the word order would have been reversed: "*pi*vo u

vas cho*lod*noe?" (is the beer you have cold?). If in the second rise in the utterance "u vas cho*lod*noe *pi*vo" a higher point is reached than in the first rise, not only a perceptual but also a functional difference is introduced: the speaker now expresses his surprise that there is beer at all, which happens to be cold. If one prototype of this type of pitch accent were given, the two rising pitch accents would have been stylized equally high and the linguistically relevant issue would be overlooked. In the given example it would be perceptually and linguistically unacceptable.

Summarizing, my work has been carried out in the following order:
- close-copy stylizations based on perceptual equality between the original version and the stylized version, verified in perception experiments;
- the classification of perceptually relevant pitch movements based on the criterion of perceptual equivalence, verified in perception experiments;
- the description of types of pitch accent that were found to exist.
For a standardization further activities would be:
- a study of the interpretations and meaning of the established types of pitch accent;
- the stylization of types of pitch accent into as many standards as are linguistically justified;
- a definition of phonetic specifications for the standard types of pitch accent.
My study did not include these three activities.

3.5 A first attempt at classifying pitch movements

The first excerpt of the corpus that has been analysed is a quasi-spontaneous monologue by the opera director B.A. Pokrovskij, published elsewhere (Odé 1986). This article described how pitch movements were classified into groups of perceptually similar (configurations of) pitch movements. The classification in the present section is taken from the article. After a description of every group, the problems I was left with and suggestions for solving them are discussed.

3.5.1 Sorting the pitch movements

In the Pokrovskij excerpt pitch movements are *classified* (see section 3.3) into ten groups, running from A to J. Every group contains *perceptually similar (configurations of) pitch movements.* In order to verify the close copies of the

excerpt, original fragments and close copies were recorded on tape in pairs and presented to a native audience of about thirty trained listeners. The close-copy stylizations have been labelled as fully acceptable. This means that no perceptually relevant difference was heard between the original recording and the close copies.

I made the classification by means of the Bell and Howell Language Master System. The excerpt has been divided into stretches of approximately three seconds. These stretches were recorded on cards with magnetic tape with a maximum duration of three seconds. A card does not give any written information about a stretch, except for its number. Cards can be listened to in random order by passing them through the Language Master groove with replay head.

Actual sorting, in order to classify the pitch movements, was carried out by listening to and comparing the cards. I sorted pitch movements with a high resemblance and listened to each group repeatedly. If a pitch movement did not really "fit" into a group after all, I compared the movement with another group. In this way, by shuffling and weighing the cards against each other, ten groups of (configurations of) perceptually relevant pitch movements were found to exist. The classification as such has not been verified in a formal perception experiment, but a small group of trained listeners has accepted my classification. A survey of the ten groups is given in figure 3.7. For phonetic data see Odé (1986).

The typology of the ten groups that follows is strictly limited to the excerpt

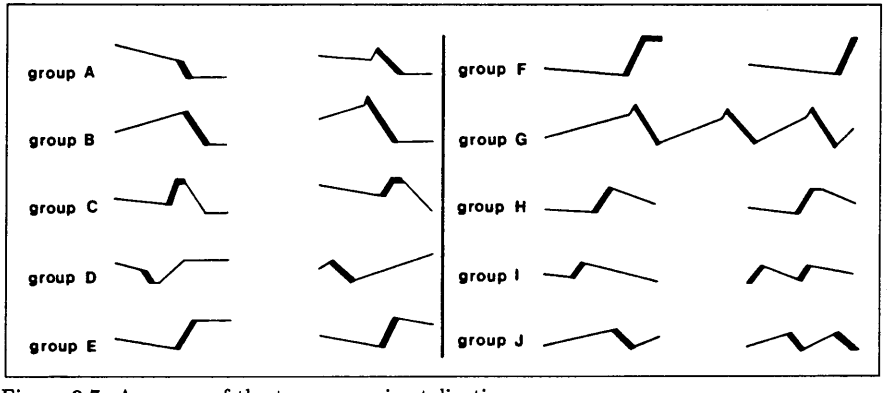

Figure 3.7: A survey of the ten groups in stylization

spoken by Pokrovskij. As already mentioned, it was my first attempt at classifying Russian pitch movements. For examples of the ten groups the reader

is referred to the article (Odé 1986), in which some interesting cases are discussed in detail.

Group A

To group A belong all falls in tonic syllables with or without a *zanos* (a set-up before a fall, see section 5.5.2) which reach the lowest frequency of the given speaker and are not preceded by a rise within the tonic syllable. The pretonic syllable can be higher than the beginning of the tonic syllable or on the same level, but it may also contain a gradual rise or a *zanos*. The tonic fall can start in the pretonic syllable(s). Sometimes the tone has reached the low reference level in the pretonic syllable. In that case the tonic syllable is on the low reference level, and posttonic syllables continue on that line. According to this description we find the following realizations in figure 3.8 (the bold line indicates how pitch actually moves in the accented syllable).

The accents classified into group A indicate a boundary. They can be labelled

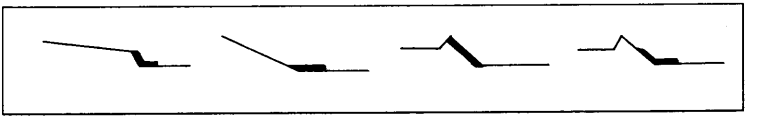

Figure 3.8: Group A realizations

as final falls.

This pitch accent is known in the literature on Russian intonation as Intonation Construction No. 1 (IK-1) in Bryzgunova's classification (1977).

In some cases of group A the fall in the tonic syllable does not really reach the low reference level. Yet perceptually they are too much of an A type to form a separate group. The posttonic syllables continue on the same line, which is not low and which I have therefore called the non-low reference level. A fall such as this can very often be observed in spontaneous speech.

Group B

Group B consists of another type of fall. I separated this type of fall from the A type, because it differs from group A in that the tone necessarily falls in the tonic syllable, and thus cannot be level in the tonic syllable on the low reference level as it can be in group A.

Representatives of group B are given in figure 3.9 (the bold line indicates the accented syllable).

In the pretonic syllable(s) the tone gradually rises or contains a *zanos*.

A further important feature of group B is that a possible short rise or level

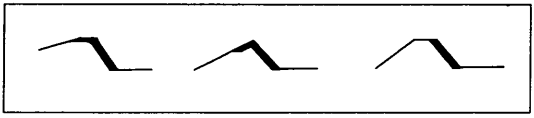

Figure 3.9: Group B realizations

high tone preceding the fall in the tonic syllable can occur. After the rise or level high tone the fall must follow immediately, otherwise the accent may be confused with realizations in group C. The excursion in group B is fairly large and not extremely steep.
In this text the group B type of pitch accent appears as a final fall and occurs at a boundary in an enumeration. As regards the position of a fall, the group A type and group B type compete for their choice. What actually makes the speaker decide to use one of the two types has been left out of the discussion, but roughly speaking type B gives the impression of being more "emphatic" than type A.
Group B falls show some similarities with IK-2 in the classification of Bryzgunova. As is well known from the literature on Russian intonation, in IK-2 intensity seems to be of some relevance. In my examples this was just a concomitant feature, since the difference between type B falls and other types of falls could be made audible by changing only F_0.

Group C
Group C represents a pitch accent which is perceptually very easily distinguishable, and known as very Russian.
There are many realizations of the group C type, but in Pokrovskij they could always be stylized in the same way without any perceptual difference between the stylization and the original F_0. As soon as this stylization was found, all pitch accents of group C could be described in the same terms. A group C accent has a very steep rise with a large excursion early in the tonic syllable. Part of the rise can be realized in the pretonic syllable(s). After the rise the tone is high and level and sometimes begins to fall at the end of the tonic syllable. In the posttonic syllable(s) the tone falls steeply and reaches the low reference level, thus always being lower than in the pretonic syllable. Group C realizations are presented in figure 3.10 (the bold line indicates the accented syllable).
In Pokrovskij the group C type is found as a last pitch accent before a boundary, but elsewhere in Russian the group C type also occurs as interrogative intonation in sentences without a question word. In the wh-questions in this

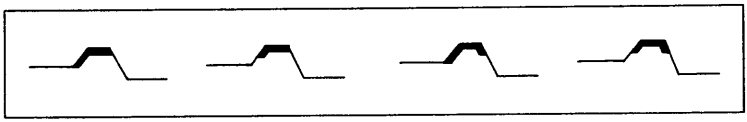

Figure 3.10: Group C realizations

text a group C type does not appear. Pokrovskij does not use many questions at all in his talk. This probably has to do with the fact that the type of speech is a monologue: outside the excerpt analysed Pokrovskij uses the group C type only occasionally as an interrogative intonation in rhetorical questions.
If precisely the group C realizations are meant, they correspond to IK-3 in Bryzgunova's classification. This statement cannot be reversed: when Bryzgunova uses the label IK-3 the configuration of movements meant is not necessarily a representation of group C, since the label IK-3 as used by Bryzgunova does not correspond to a single type of pitch accent.

Group D
The posttonic syllables are decisive for the description of the configuration of pitch movements in group D. After the fall to the low reference level, on which the tone can continue within the tonic syllable (see also group A), the tone rises and continues in the posttonic syllables on the level reached, or rises gradually until the end of the utterance. Representatives of group D are given in figure 3.11 (the bold line indicates the accented syllable).
If the posttonic syllables are cut off, the pitch movement within the tonic

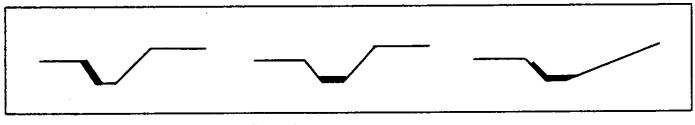

Figure 3.11: Group D realizations

syllable itself can be classified in group A. Here the posttonic syllables decide that the configuration as a whole differs from group A.
A group D type occurs in syntactically heterogeneous positions. In Pokrovskij's text it is used as a continuation contour.
In the classification of Bryzgunova we find realizations of this type under the name IK-4. As we have seen in group C, we must be very careful in comparing Bryzgunova's classification with mine, since Bryzgunova seems to confuse phonetic data with the function and meaning of the seven IK-'s of her system,

whereas in my classification the perceived melodic course is the only criterion. "The criterion of perceptual discreteness is not always met by Bryzgunova's inventory of contours; some of her IK's are described as being only gradiently different. (...)Examples are some of the nondiscretely different contours (...), which are being differentiated because of the different functions they are presumed to have, and some of the "modal realizations" of IK's, which are being classified on the basis of their presumed function instead of their form" (Keijsper 1983: 104-106).

Group E

The posttonic syllables are decisive for the description of the group E type of pitch accent (see also group D).

The group E type of pitch accent suggests a continuation. It consists of a rise in the tonic syllable with a large excursion (see group C), but now followed by one or more high posttonic syllables that may show some declination (the tendency of F_0 to float down gradually in the course of an utterance, see section 5.4.1). In figure 3.12, with examples of group E, the bold line indicates the accented syllable.

In one case, although the posttonic stretch is high, this posttonic stretch is so

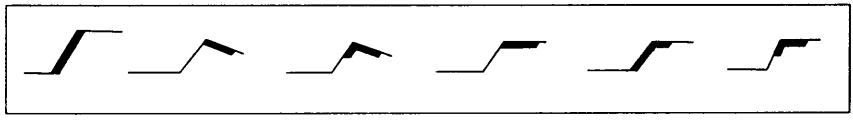

Figure 3.12: Group E realizations

short that perceptually it belongs almost to group F (see below). In another case the entire rise is realized in the pretonic syllable.

In Bryzgunova's classification group E realizations are called IK-6, but the reverse does not hold in my classification (see also the remark in group C).

The group E type competes with some realizations in group H, though perceptually there is a difference between the two groups. This problem is discussed in group H.

Group F

If a full and steep rise of the type described in group C and in group E is realized, and the pitch accent happens to be in the last syllable of an utterance or at a boundary, the opposition between the two types is neutralized. In the examples in figure 3.13 the bold line indicates the accented syllable.

The neutralized group C or group E types are put in group F.

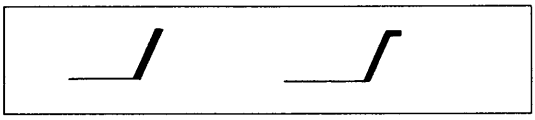

Figure 3.13: Group F realizations

The tonic vowels are longer than in group C and in group E, as is always the case in final syllables.
It would be interesting to find out by which type a native speaker would replace a group F type if he were urged to replace a group F type word by a word with posttonic syllable(s). Sometimes, while listening to a longer stretch (a whole utterance or a few utterances one after another) the type which would probably be used can be guessed by the intonational context.
It was questionable whether pitch movements of the type of group H (see group H below) show neutralization in words with the pitch accent in the final syllable since the features of group E and group H could not yet be clearly defined in this first classification.

Group G
The configuration of pitch movements of the group G type is discussed separately as the harmonica pattern (see below). The bold line in the examples in figure 3.14 indicates the accented syllable. This type has not been described in the literature.

Figure 3.14: Group G realizations

Group H
Group H was the most problematical type of all ten groups. As already mentioned, a group H type was sometimes hard to distinguish from a group E or group F type. There were many relevant factors in this respect, for example, the posttonic syllables, the intonational context and the acoustic features of the tonic syllable. Realizations of the group H type can also differ from one another, yet they were perceived as belonging to the same group. Since the rises differ from one another in group H, it is probable that other features characterize the group H type.

Representatives of group H are given in figure 3.15 (the bold line indicates the accented syllable).
The question was whether group H is indeed a perceptually separate and thus

Figure 3.15: Group H realizations

discrete group, or whether it is the same rise of group E but over a smaller range. The type has not been identified in the literature.
A further question was whether a group H type, like the group C and E types, is neutralized if the syllable with pitch accent is the final syllable. In Odé (1986) I suggested the construction of perception experiments devoted to the difference between the group E type of pitch accent and the group H type of pitch accent (see chapter 4 below).
Another problem was the relevance of posttonic syllables. I formulated the following questions:
- Is there a significant difference between posttonic syllables which are level, or which continue on the declination line, or which fall but do not reach the non-low reference level?
- Can anything be said about the type of pitch accent which follows a group H type, or about the length of the following fragment until a boundary or the end of an utterance is reached? In other words, does a group H type convey information about how pitch will continue? The group H type does not suggest that a conclusion follows soon. The flow of thoughts is unfinished.
- Among all the features mentioned, which define(s) a group H type?

Group I
The group I type of pitch accent was described as a neutral type, that is: not a main pitch accent before a boundary. Group I realizations are part of the sawtooth pattern occurring before a main pitch accent (see below) or occur separately before a main pitch accent.
According to my classification of Pokrovskij, all type I accents are perceptually rises; acoustically the tone can be level in the tonic syllable and sometimes a fall begins within the tonic syllable (perceptually this is not relevant). In the examples in figure 3.16 the bold line indicates the accented syllable. The rises are less steep and the excursion is smaller than the rises in groups C, E and F.

Group I types, as well as group J types (see below), precede main pitch ac-

Figure 3.16: Group I realizations

cents. So accents in group I itself always occur as "neutral", non-main pitch accents. Where a group I accent occurs before a boundary, the stretch involved is an "afterthought". In the text a group I type is followed by group A, C, D, E and H realizations, and preceded by a group J type or another group I type. This type has not been described in the literature.

Group J

The description of the group I type holds true for group J. The only difference between the two groups is the direction of the pitch movement: in group J the tone falls and is the reverse of the group I type. The bold line in figure 3.17 indicates the accented syllable. In the text a group J type is less frequent in the analysis than the group I type.

A group J type precedes the main pitch accent, so it occurs as "neutral",

Figure 3.17: Group J realizations

non-main pitch accent. The group J type can be followed by group A, C, D, F, H and I realizations and can be preceded by type I or by another group J type. Type J has not been described in the literature.

In table 3.1 it can be seen how the ten groups of pitch accent are combined with one another in the analysed excerpt from Pokrovskij. There are no combinations of main pitch accents within one fragment except for group G where this might even be a rule. Representatives of group B occur only in isolation. All the other main pitch accents are preceded by group I and J types which differ in number and combination.

Note that the ten groups just described are not equivalent: whereas one group may be defined by a single pitch movement, more pitch movements must be taken into consideration in order to describe other groups. Thus the ten

	A	B	C	D	E	F	G	H	I	J
G							x			
I	x		x	x	x			x	x	x
J	x		x	x		x		x	x	x

Table 3.1: Combinations of the ten groups: pitch accents on the x-axis following pitch accents on the y-axis

groups cannot be compared as equal units. Nevertheless, in order to give an impression of the combination of groups in this particular text, they may be represented here on an equal level.
The pitch accents on the x-axis should be read as following the pitch accents on the y-axis within one fragment.
Two intonation patterns (fixed combinations always consisting of the same configuration of pitch movements) were found to exist while sorting the pitch movements: the sawtooth pattern and the harmonica pattern.

The sawtooth pattern
The sawtooth pattern consists of one or more pitch accents of type I or J, i.e. a main pitch accent is not found in a sawtooth pattern itself, but this pattern is usually followed by a main pitch accent. The prominent syllables in the sawteeth in one sequence either rise or fall. After a rising tooth the tone gradually falls and after a falling tooth the tone gradually rises. In the examples in figure 3.18 the bold line indicates the accented syllable.
In the text some prominent syllables in the sawtooth pattern show a fall on

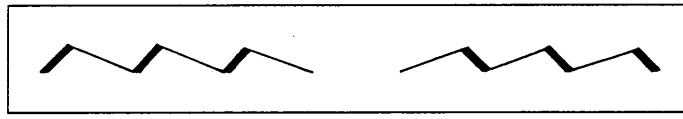

Figure 3.18: The sawtooth pattern

the acoustic level, whereas the other prominent syllables in the same sequence acoustically rise. However, on the perceptual level the direction of the pitch movement in the prominent syllables is always the same in one sequence, which means that the rise takes place in the pretonic syllable in some cases. The analysis of Pokrovskij, as well as other texts, seems to indicate that a non-main pitch accent in Russian has the form of a sawtooth, and not of a pointed hat or terrace pattern (see figure 3.19) which we find in Dutch (Collier and 't Hart 1981).

While stylizing Pokrovskij's talk, it proved that an artificially made pointed

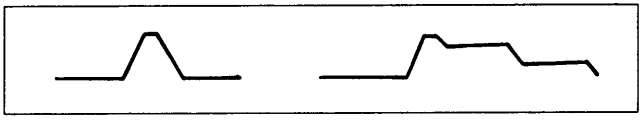

Figure 3.19: The pointed hat and the terrace pattern

hat or terrace pattern differed significantly from the original, and thus had to be rejected. In one fragment the pitch accents in the sawtooth pattern were changed into pointed hats for experimental purposes. In an audience of native speakers of Russian (all phoneticians and trained listeners) these pointed hats were labelled as unacceptable and non-Russian. So we may not only conclude that a pointed hat is not the neutral type of pitch accent, but also that it simply does not seem to exist in modern spoken Russian. A modification from a sawtooth pattern into a terrace pattern gives the effect of scanned speech and sometimes it seems as if the speaker wants to sing. So the terrace pattern also seems to be unacceptable.
The identification of the sawtooth pattern is remarkable in many respects. To my knowledge, this pattern has not yet been described in the literature on Russian intonation. Its existence explains why many of the pitch accents one hears cannot be classified into any of the seven Intonation Contours (IK-1 - IK-7) of Bryzgunova (1977), and certainly not in type IK-2 falls and IK-3 rises. The reason is probably that Bryzgunova classifies only main pitch accents.

The harmonica pattern
The harmonica pattern has been described as a separate group (G). The pattern is named by me after its form. The reason for treating the harmonicas separately is as follows.
The harmonica is a sequence of falling movements which cover the full range and are preceded by a *zanos* (see figure 3.20).
An important feature of the harmonica pattern seems to be the close succession of pitch accents, which are all of the same type. At the end of the fragment in figure 3.20 the tone rises slightly in the posttonic syllable, as if another similar pitch accent were about to follow. The initial syllable of this sentence is high. The falls in the prominent syllables taken in isolation are comparable with the falls in group B. (See also section 4.6.) It is these features, viz. the *zanos*, the prosodic context, the high expressiveness and, presumably, the meaning of the pattern, that justify a separate treatment.

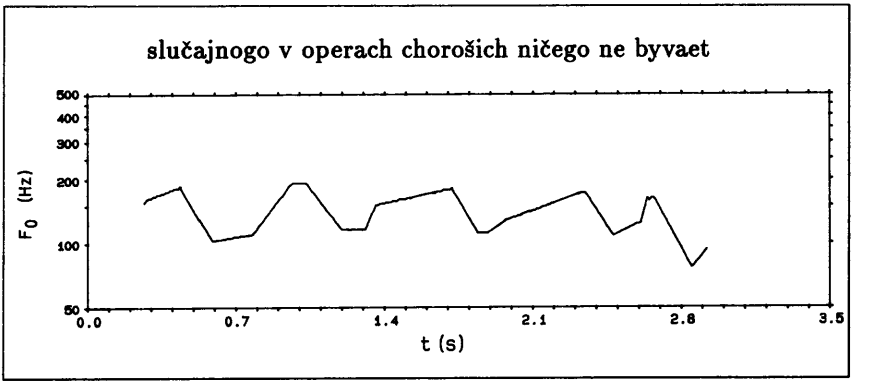

Figure 3.20: The harmonica pattern in a stylized fragment of Pokrovskij

More examples of this pattern were required for the description of its meaning. Native speakers of Russian, especially linguists and phoneticians, say that this intonation pattern is characteristic of colloquial speech.

3.5.2 Inventory of problems

The classification of pitch movements in the Pokrovskij excerpt has been taken as the starting point for a perceptual description of Russian intonation. On the basis of the classification, an inventory could be made of problems that had to be solved in perception experiments and in further analyses of new excerpts.
I will list the inventory of problems I was left with after the first classification in the same order as I tackled them.
The questions that required an answer are repeated in the sections on the experiments (chapter 4) devoted to these questions.

Rising pitch movements
The differences between the configurations of pitch movements in group C and group B (known as IK-2 and IK-3 (Bryzgunova 1977)) are insufficiently described in the literature. These differences are of linguistic as well as didactical importance: the two pitch accents are a notorious stumbling block for foreign students of Russian. While classifying pitch movements in the excerpt from Pokrovskij I paid special attention to the two configurations. For a description of the differences see groups B and C in section 3.5.1, chapter 5 and figure 8.1 in chapter 8.

In the process of studying the perceptual and phonetic differences between the two types of pitch accent, group H was found to exist. To my knowledge, this type of pitch accent has not been explicitly described in the literature, so from then on I also focused on group H.
Group H realizations are melodically similar to one another, yet phonetically they may vary considerably. Moreover, it was not clear what the limits of perceptual tolerance were. Group H realizations were sometimes very close to group E if the excursion was large, and very close to group I if the excursion was small. The posttonic syllables after a group H rise always fall, but not to a point as low as in group C.
The questions about group H were:
- Group H and group E realizations can both have a large, steep rise with a high or slightly declining posttonic part. Yet differences can be perceived. What is the difference between group H and group E in the tonic and in the posttonic syllables?
- Group H and group I realizations have been kept apart. But what is the difference between group H and group I if the excursion in both groups is small?
- The falling movement in the posttonic syllables in group H varies from slightly falling to almost a low level. Are the posttonic syllables in group H never as low as in group C?
Perception experiments were devised in order to answer these questions (see sections 4.2 and 4.4).
In the classification I had also noticed a linguistic difference between group H and group E. It was assumed that a group H realization did not anticipate the occurrence of a last pitch accent, while after a group E realization a final pitch accent was expected to follow soon. I devoted a writing test to this difference (section 4.3).

Falling pitch movements
Groups A and B were not very clearly described. Both groups occur with a *zanos* and show realizations where a fall reaches the low or the non-low reference level. Yet a perceptual difference was observed.
I formulated questions about falling pitch movements, as follows:
- Is there a difference between the low and the non-low reference level?
- Does a difference exist between low and non-low for both A and B?
- What are the discrete differences in excursion and/or in timing and/or in posttonic syllables between group A and group B?

- Does group G (the harmonica pattern, see section 3.5.1) consist of a sequence of only group B realizations with high posttonic parts?
- Is there a discrete difference between group J realizations and group A non-low and group B non-low, supposing a discrete difference between low and non-low exists?

The questions about falling pitch accents were translated into three perception experiments, which will be described in section 4.6.
The test items for the three experiments about group H, E and I were taken from the excerpt from Pokrovskij (sections 4.2, 4.3 and 4.4).
As time went by, new excerpts were analysed, stylized, classified and added to the corpus. The test items for a follow-up experiment about rising pitch accents after the first three tests were therefore taken from different speakers. The follow-up experiment (section 4.5) was aimed at solving problems which still existed after questions about group H, E and I had been answered.
The test items for the experiments devoted to falling pitch accents were selected from all excerpts of the corpus.

Chapter 4

Perception experiments

4.1 Introduction

In section 3.5 a first attempt at classifying pitch movements has been discussed. This classification led to an inventory of problems which were suggested as being solvable in perception experiments and in further analyses of new speech material. The experiments devoted to various problems will be presented in this chapter in the order in which they were carried out.
All the experiments were conducted at Leningrad State University. The participants in the first three experiments were professors, research assistants and teachers of the Department of Phonetics and students of the Faculty of Arts. For the last two experiments the tasks were performed only by professors and scientific researchers in the field of linguistics/phonetics at the Department of Phonetics. My subjects suffered a lot as I confronted them in the tests with my problems. But their concentration during the experiments expressed the willingness and enthusiasm of the subjects to participate in the experiments and to evaluate the judgments afterwards.

4.2 The sorting experiment

This section discusses a listening experiment which was conducted in order to find out how many types of rising pitch accent must be distinguished in Russian intonation. The linguistic material was taken from a quasi-spontaneous monologue. The experiment was set up as an individual sorting test for twenty native subjects. Twenty (fragments of) utterances were selected for this test. The subjects were instructed to classify rises on the basis of melodic resemblance.
The sorting experiment has already been published separately (Odé 1988).

4.2.1 Problem

In Odé (1986) I analysed a two-minute excerpt from a monologue by the opera director B.A. Pokrovskij (see also section 3.5). In the analysis five rising pitch accents were distinguished: C, E, F, H and I (see figure 4.1). The bold line in figure 4.1 indicates the perceptually relevant rise.

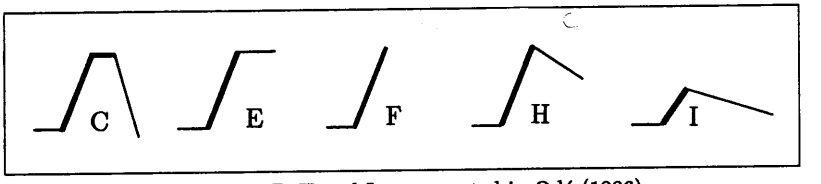

Figure 4.1: The rises C, E, F, H and I as presented in Odé (1986)

It was assumed that C and E (neutralized in F) have the same type of rise (steep, large excursion) but different posttonic parts. Group I seemed to be another type. As described in Odé (1986), it occurs before a main pitch accent, not before a boundary (except in afterthoughts). Besides C, E and F as a main pitch accent before a boundary, a type comparable with type I occurs. It has been called type H. This type was not easy to describe. Perceptually the type H realizations are similar to one another, yet they vary phonetically. Type C is comparable with Bryzgunova's (1977) IK-3 in a question without a question word and type E is comparable with some of the realizations of her IK-6. Bryzgunova does not describe a pitch accent comparable with type H or type I.

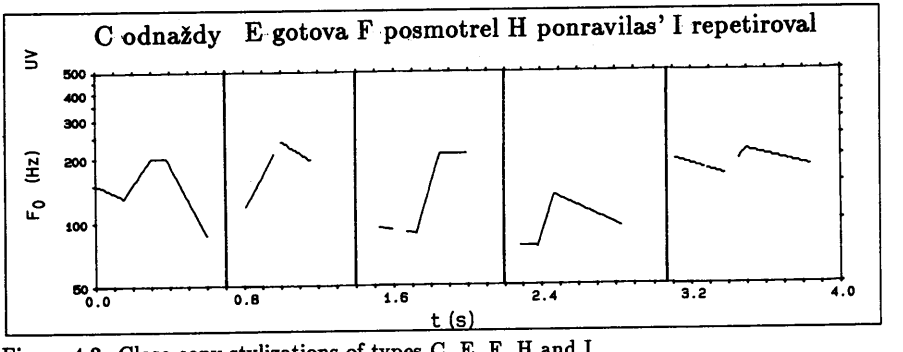

Figure 4.2: Close-copy stylizations of types C, E, F, H and I

The pictures in figure 4.2 give some representative examples of the rises C, E, F, H and I.

On the x-axis the time scale is given in seconds; on the y-axis the logarithmic scale is in hertz.
A perception experiment was set up in order to find an answer to the following questions:
1. Is there a discrete difference between type H and type I?
2. What is the difference between type E and type H?

4.2.2 Experiment

Twenty utterances or fragments from utterances were selected for the experiment. According to my classification they had the following composition: type C: 2 stimuli, type E: 4 stimuli, type F: 2 stimuli, type H: 6 stimuli, type I: 6 stimuli.
Although the experiment was devoted to types E, H and I, type C and type F were also represented in the test in order to prevent subjects from engaging in analytic listening, i.e. hearing too many details. Most examples were taken from groups H and I, because questions about these groups were considered the most complicated. Since it was not clear whether the tonic and/or posttonic parts are responsible for the distinction between types E, H and I, a number of test items were included without posttonic parts: type F and realizations of types H and I. In total there were twenty stimuli, because sorting more than twenty stimuli would have been a much too difficult task for the subjects.
The individual experiment was executed by means of the Bell and Howell Language Master System (see section 3.5). The twenty stylized (fragments of) utterances were recorded on cards with magnetic tape. The text and number of the 20 stimuli were printed on the cards and the words with rising pitch accents were underlined. In the twenty stimuli in table 4.1 the accented syllables in the words with pitch accent are printed in italics.
Subjects could listen to the stimuli in random order as many times as necessary.
The instruction was to find melodic similarities between the twenty rising pitch accents. For this broad listening task the subjects were asked to pay attention solely to the melody in the underlined word. They were not informed about the number of groups they had to find, since finding the number was the aim of the experiment. In the instruction preceding the actual test two examples of resynthesized speech were given in order to acquaint the subjects with the quality of such speech. Melodic similarities and differences in four

examples of two utterances each were presented on tape. After the instruction there was time for questions.
A group of twenty native subjects took the test at the Department of Phonetics of Leningrad State University. There were ten trained and ten untrained listeners.
The subjects sorted the twenty stimuli into as many groups as seemed appropriate to them after listening. They then verified their own classification by listening again to every group separately.
The time needed for the task varied among the subjects from ten minutes to one hour and a half.

1.	i kogda scena byla go*tova*	and when the scene was *rea*dy
2.	scena nam očen' pon*ravilas'*	we *like*d the scene very much
3.	vse stali *nervn*ičat'	everybody got *ner*vous
4.	i nam poka*zalos'*	and it *seem*ed to us
5.	v tom klju*če*	in the same *key*
6.	i pervyj konečno stal nervničat' Nikolaj Se*men*ovič	and first of all of course Nikolaj Sem*ë*novič got nervous
7.	on posmo*trel*	he *watch*ed
8.	ja pere*sta*vil scenu	I di*rec*ted the scene again
9.	scena uda*las'*	the scene was a suc*cess*
10.	v tom *pla*ne	in the same *way*
11.	ja pozval na repe*ti*ciju	I called to come to the re*hear*sal
12.	ja repe*ti*roval	I re*hear*sed
13.	kogda my stali repetirovat' s or*kes*trom	as we started to rehearse with the *or*chestra
14.	i tog*da*	and *then*
15.	imeja v vidu ėmocional'nyj cha*rak*ter	with a view to the emotional *char*acter
16.	kakie-to interesnye vzaimootno*še*nija	some interesting inter*ac*tions
17.	ee soprovoždaet or*kestr*	she is accompanied by the *or*chestra
18.	meždu *dej*stvujuščimi licami	between *char*acters
19.	i emu *o*čen'	and he *ve*ry much
20.	ja pomnju kak od*naždy*	I remember how I *on*ce

Table 4.1: The twenty (fragments of) utterances used in the sorting experiment

4.2.3 Results

The judgments of the twenty subjects were coded into a similarity matrix and subjected to an analysis based on the theory of hierarchical clustering by Stephen C. Johnson (Johnson 1967). For the hierarchical cluster analysis I used a computer program which had been written by D. Bouwhuis at IPO.
In the hierarchical cluster analysis, data were clustered according to a maximum and a minimum method. For these data the maximum method was used, i.e. the 20x20 judgments were clustered as early as possible. The aim of the experiments was to find clusters of perceptually equivalent pitch movement. By using the minimum method, in contrast, the clustering would have been postponed as long as possible, i.e. in that case differences between individual realizations would have been brought to light.
The outcome of the hierarchical cluster analysis is presented in figure 4.3. The letter above the stimulus number indicates the type of rise according to my classification. Figure 4.3 shows that the first cluster was found at a level of 16 out of 20, i.e. 16 out of 20 subjects classified stimuli 2 and 9 together. Then, on level 15, stimuli 1 and 15 cluster, etc.
The lower the level of a cluster found in the analysis, the lower the strength of the cluster. For these data it seems that below level 7 no more relevant clusters are found.

4.2.4 Conclusion and discussion

The clustering scheme in figure 4.3 clearly divides the twenty stimuli into different groups. Above a horizontal line immediately below level 7 the division of the stimuli from left to right is as follows:
level 12: stimuli 16, 9, 2 (type H)
level 8: stimuli 14, 8, 15, 1, 7, 6 (types E, F)
level 7: stimuli 10, 5, 12, 11, 17, 3 (types H, I)
level 12: stimuli 20, 13 (type C)
Stimuli 4, 18, 19 are omitted here and will be discussed below.
Type C clusters very well. Types E and F also cluster, though stimuli 8 and 14, 1 and 15, 6 and 7 were first grouped together on a higher level. As for types H and I, which are joined to types C, E and F only at the lowest level (which is not relevant), the picture is far more complicated. Three out of six type H realizations cluster at the high levels 16 and 12.
For a better understanding of why stimuli do or do not cluster, the specification of the phonetic features of the stimuli must be taken into account.

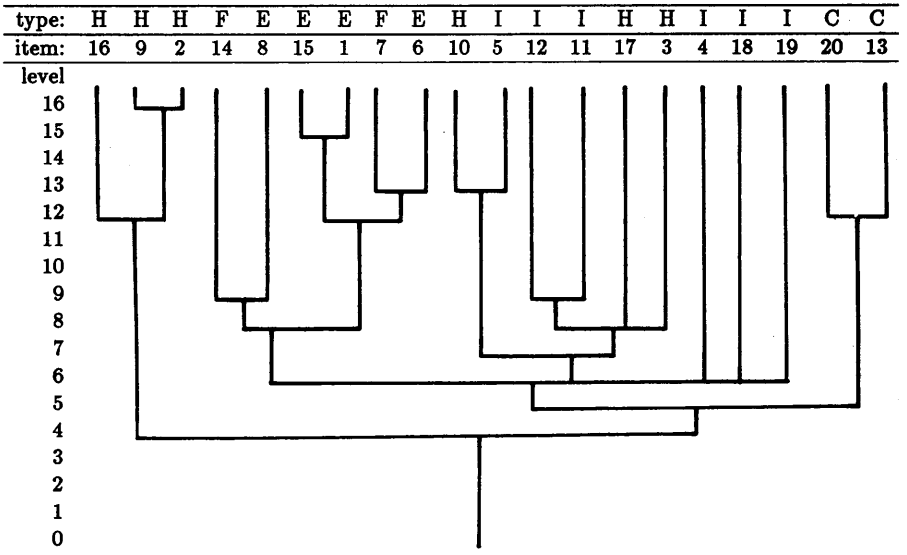

Figure 4.3: Outcome of the hierarchical cluster analysis using the maximum method of the sorting scores

In table 4.2 the phonetic specification of the stimuli is given. For a detailed description of phonetic features see chapter 5. Here, it suffices to say that rises with large excursion end high in the speaker's register, and that rises with normal excursion end in the lower part of the register. Further, the term *middle posttonic part* refers to a field between high and low.

The clustering scheme confirms that indeed types H and I were something of a problem for the classification of rising pitch accents and needed to be tested in a listening experiment. Probably an exceptional case is no. 19, which has a late timing and a steep slope. In figure 4.3 it stands alone and is added to two other problematic cases (nos. 4 and 18) that do not cluster above level 7. It is understandable that a sudden rise at the end of a very high accented vowel was not easy to classify. It is probably nothing more than an emphatic variant of a rising accent with late timing and gradual slope (no. 17).
Stimuli nos. 2, 9 and 16 with normal excursion cluster very high, while 4 and 18, which also have a normal excursion, are joined separately at a low level (which is not relevant). Nos. 4 and 18 do not cluster with any of the other groups. Stimulus no. 18 was separated by no fewer than 11 subjects,

feature	C	E,F	H,I				H	I
excursion	large	large	large				normal	normal
posttonic part	low	high	middle				middle	middle
timing	early	early	early		late		early	late
slope	steep	steep/ gradual	steep	gradual	gradual	steep	steep/ gradual	steep/ gradual
stimuli	13,20	1,6,8,15 (7,14)	10 (5)	11,12	17 *3*	19	2,16 (9)	4,18

Table 4.2: Specification of the phonetic features of the 20 stimuli. The numbers in brackets are stimuli without posttonic part. For no. 3 see the text.

and no. 4 by 7 subjects. Stimulus no. 18 occurs in an afterthought very low in the register, which makes it different from the other rises; stimulus no. 4 occurs in a parenthesis also low in the register. Further on (see section 4.5.5) we will see that the two stimuli belong to a type of pitch accent with normal excursion and middle posttonic part.

An integration of the clustering scheme and the phonetic specification of the 20 rising pitch accents brings to light the features on the basis of which the classification was made by the twenty subjects:

1. The size of the excursion.

The 20 stimuli are divided into three groups of rising pitch accent with large excursion and two groups with normal excursion.

2. The posttonic part.

2.1 With large excursion:

The stimuli with large excursion are basically classified according to the posttonic part: low, high or middle. But timing and slope are associated with high and middle posttonic parts to such an extent that they may compensate for the absence of, overrule or contradict the posttonic part, in the following way:

- the combination of late and gradual overrules the cue given by the posttonic part: no. 3 has a high posttonic part but clusters with middle because it has a late and gradual rise;
- the combination of late and steep deviates with a middle posttonic part: no. 19 does not cluster with other stimuli because it has the combination of middle and late and steep; but as indicated above, no. 19 is probably just an emphatic variant of middle and late and gradual;

- if there is no posttonic part, steep clusters with a high posttonic part (nos. 7 and 14), and gradual clusters with a middle posttonic part (no. 5). (If no. 5 were steep it would probably cluster with type F realizations. This is not quite clear since the syntactic structure and meaning of nos. 5 and 10 are almost the same: *v tom plane - v tom ključe.*)

Thus, there is a basic association between high and early and steep, and a basic association between middle and late and gradual. But not all three features need be present in a given case:

- the combination of high and early makes slope redundant: nos. 1, 6, 8 and 15 cluster despite their varying slope;
- a middle posttonic part makes both timing and slope redundant (but is mostly combined with gradual, and is probably emphatic with late and steep - see above): nos. 3, 10, 11, 12 and 17 cluster despite their varying timing and slope.

The stimuli with a low posttonic part (nos. 20 and 13) both had an early and steep rise, so nothing can be said about redundancies here.

Generally speaking, then, we can say that there are three types of rising pitch accent with a large excursion: with high, middle and low posttonic parts. Since it is sometimes cues of timing and slope that keep the three types apart, as outlined above, a specification of the posttonic part alone is not sufficient.

2.2 With normal excursion:

The posttonic part is middle or ø.

There are two groups with normal excursion: nos. 2, 9 and 16 with early timing and nos. 4 and 18 with late timing. The slope varies.

Returning to the two questions in section 4.2.1 the following answers can be given.

Question 1:

In Odé (1986) I classified group H and group I into two types on the basis of two criteria: the actual excursion in the perceptually relevant pitch movement, which says nothing about register (see sections 5.2.1, 5.2.2 and 5.2.3) and the position in the utterance, i.e. at a boundary (H) or elsewhere (I). The sorting experiment has shown that the difference between type H and type I is neither the actual excursion in the movement nor the position in the utterance as described in Odé (1986) (see section 4.2.1): subjects discriminated between accents with a middle posttonic part on the basis of large and normal excursion, which terms are defined with respect to the low reference level (see section 5.2.3). Of course, pitch accents with large excursion usually

occur as the main pitch accent before a boundary and pitch accents with normal excursion mostly occur elsewhere. In conclusion, types H and I must be redefined.
The issue of whether a discrete difference does indeed exist between large and normal excursion in the case of rising pitch accents with middle posttonic part will be discussed in section 4.5.
Question 2:
Type E and type H/I realizations do not cluster significantly: they are indeed different types. The difference is basically the posttonic part, but with the complications concerning timing and slope mentioned above.

4.3 The writing test

Linguistically speaking, type E and type H/I as described in section 4.2 show an interesting difference. My impression after listening to a great number of assumed type E and type H/I realizations in different recordings of spontaneous speech was that after a type E pitch accent a final pitch accent was soon to follow, i.e. type E announces the last pitch accent. Type H/I, on the contrary, does not anticipate the occurrence of a last pitch accent. The possibility cannot be ruled out that it is a last pitch accent itself, but in most cases it is followed by another realization of the same type.
In order to verify this impression I devised a writing test. Subjects had to complete ten (fragments of) utterances (seven of which were also used in the sorting experiment) with five type E and five type H/I pitch accents. The 10 stimuli were recorded in the original version on cards with magnetic tape (see sections 3.5 and 4.2.2).
The same twenty subjects listened to the cards and completed the stimuli in such a way that the intonation in the stimuli remained unchanged and fitted into the complete sentences. The subjects wrote the results down with punctuation marks and read them aloud to check the intonation of the completed sentence.
No statistics on the results of the writing test are presented, because in this test stimuli with different texts are compared. Yet the results of the test confirmed my expectation in a convincing way, which I would like to illustrate with a few examples. The examples can be compared with one another on the basis of the results from the sorting experiment (section 4.2). In this experiment the examples of type E cluster. The examples of type H/I do not cluster, probably because of the difference in excursion.

The writing test has been published separately together with the sorting experiment in Odé (1988).
In the writing test stimuli 1, 6, 8 and 15 (type E) were immediately or soon followed by a final pitch accent.
Stimuli 3, 9 and 10 (type H/I) were extended considerably and some subjects indicated with the mark '...' that the sentence could continue endlessly in the same intonational way.
Examples of both types are presented below.

Stimulus no. 1 (type E):

i kogda scena byla go*tova*	- *, ja pošel domoj.*
	- *, ja pozval režissera.*
	- *, my načali snačala.*
	- *, vse obradovalis'.*
	- *, my sdelali pereryv.*
and when the scene was ready	- *, I went home.*
	- *, I called the director.*
	- *, we started again.*
	- *, everybody was happy.*
	- *, we had a break.*

Stimulus no. 8 (type E):

togda ja pere*stavil* scenu	- *i vse pošlo na lad.*
	- *i polučil želaemoe.*
	- *, i spektakl' udalsja.*
	- *, i stalo namnogo lučše.*
	- *i uspokoilsja.*
then I directed the scene again	- *and everything was successful*
	- *and I got what I wanted.*
	- *, and the performance was a success.*
	- *, and it became much better.*
	- *and I calmed down.*

Stimulus no. 3 (type H/I):

vse stali *nervničat'*

- *suetit'sja...*
- *serdit'sja, sporit'...*
- *, gromko govorit' i daže perešli na krik.*
- *, suetit'sja, obraščat'sja drug k drugu s nelepymi voprosami.*
- *, bespokojno osmatrivat'sja, nedaleko bylo do paniki.*

everybody got nervous

- *began to bustle...*
- *got angry, began to argue...*
- *, began to talk loudly and even to cry.*
- *, began to bustle, to ask one another absurd questions.*
- *, began to look around uneasily, there was almost panic.*

Stimulus no. 9 (type H/I):

scena uda*las'*

- *, aktery byli v udare,...*
- *, byla zaveršena, my vse oblegčenno vzdochnuli.*
- *, byla jarkoj, ubeditel'noj.*
- *, v zale razdalis' aplodismenty, i avtor poblagodaril akterov za prekrasnuju igru.*
- *, artisty byli dovol'ny, i ešče neskol'ko raz vychodili na "bis".*

the scene was a success

- *, the actors were in good form,...*
- *, was perfect, we all heaved a sigh of relief.*
- *was brilliant, convincing.*
- *, in the hall the applause was heard, and the author thanked the actors for their magnificent performance.*
- *, the artists were satisfied, and returned several times to the stage for an encore.*

So type E indeed announces the end of a stream of thoughts, while after type H/I the end of the stream of thoughts may still be far off.
The last questions left about group H/I realizations are:
- the phonetic description of the posttonic middle part, and
- the difference between large and normal excursion.
Section 4.4 will discuss the posttonic middle part. Differences in excursion will be dealt with in section 4.5.

4.4 The triadic experiment

The results of the experiments in section 4.2 and 4.3 have shown that rising pitch accents with a middle posttonic part constitute a separate type. The present experiment was set up in order to find out whether the middle posttonic part has to be further subdivided.

4.4.1 Problem

In the previous experiments the differences between rising pitch accents with a high, low or middle posttonic part have been described. But what exactly is *middle* in the description of the posttonic parts?
The problem, but not the present experiment, has been discussed earlier in Odé (1987).

4.4.2 Experiment

Four (fragments of) utterances were selected from the monologue by Pokrovskij (see section 3.5). The texts and contours of the four (fragments of) utterances are presented in figure 4.4 in the stylized version. The accented syllables are indicated in italics in the text.

The phonetic specifications of the four test items are given in table 4.3. In the column "posttonic part" the excursion of the falling posttonic movement is indicated in semitones.
The falling posttonic movement in no. II has hardly any excursion, the slightly falling movement can be ascribed to declination. Yet it will probably not be confused with another type of pitch accent with a high posttonic part: in no. II the timing is late and the slope gradual. As we have seen in section 4.2, the posttonic *high* part is a distinctive feature only if the tonic part in a rising pitch movement has a large excursion and early timing.

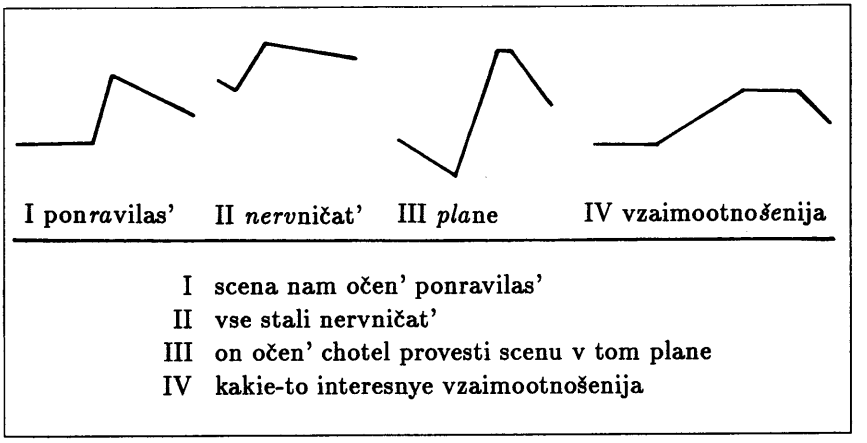

Figure 4.4: The four test items for the triadic experiment in stylization

item no.	excursion	timing	slope	posttonic part
I	normal	early	steep	-5.7
II	large	late	gradual	-1.1
III	large	early	steep	-9
IV	normal	early	gradual	-4.2

Table 4.3: Phonetic specifications of the four test items

For the experiment the posttonic syllables of the four items were varied and manipulated fan-wise into five stimuli each, leaving the rise in the accented syllable intact (see figure 4.5).

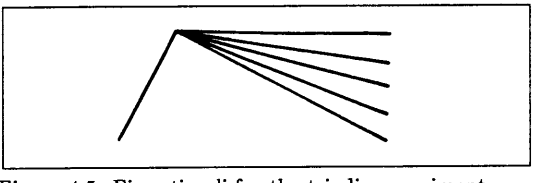

Figure 4.5: Five stimuli for the triadic experiment

In order to obtain optimal results, the five stimuli of every utterance were put into ten triads, in which all possible combinations could be compared with one another: 123 124 125 134 135 145 234 235 245 345. One triad consists of three pairs, for example triad 123 has the pairs 1-2, 1-3 and 2-3.
The original posttonic parts in the four items are, respectively, stimuli nos. 3,

1, 3, 2 in the fan. The subjects did not know which stimulus was the original one.
Subjects were asked to indicate in every triad the pair with the highest melodic similarity and the pair with the lowest melodic similarity. The experiment was performed by means of the Bell and Howell Language Master System (see section 3.5). All stimuli were recorded on cards with magnetic tape. The text and the number of every stimulus were printed on the card. The pitch accents with the posttonic parts to be tested were underlined in the texts on the cards in order to tell the subjects the part in the melody of the utterance to which they had to pay attention. The subjects were allowed to listen to every triad in random order and as many times as seemed necessary to them. They marked their judgments on a form using the sign "+" for the pair with the highest similarity and the sign "-" for the pair with the lowest similarity. One space per triad always remained empty on the form. An example is given in figure 4.4 for triad 125.

1-2	1-5	2-5
+	-	

Table 4.4: Score form for the triadic experiment

Twenty native subjects, the same group that took part in the previous two experiments, performed the task by listening to and comparing the ten triads in the four items. They had to listen to 120 cards: 5 stimuli in 10 triads for 4 items. The time needed for this experiment varied per subject from 25 minutes to one hour and 45 minutes. The subjects regarded the test as a difficult and exhausting task.

4.4.3 Results

The triadic experiment was analysed as a test for similarity between stimuli, since the aim of the experiment was to find out which stimuli between high and low belong together perceptually. The results were counted as follows: highest similarity (+) = 2 points, lowest similarity (-) = 0 points, empty space = 1 point. For every item a pair occurs three times in the ten triads. If all subjects in a given pair mark the sign "+", the maximum score for that pair is 3x 2 points = 6 points x 20 subjects = 120 points. For four items the maximum score is 4x 120 points = 480 points. A distance matrix (= distance

in score between all pairs) of the total score for the four items shows the results in table 4.5.

	1	2	3	4
2	419			
3	266	322		
4	140	204	324	
5	110	125	177	313

Table 4.5: Distance matrix of the total score for the four test items of the triadic experiment

Stimulus pair 1-2 has the highest score: 419 points.
In a one-dimensional representation of the data in the distance matrix on a ten-point scale for the scale values of the reconstructed distances, the configuration as presented in figure 4.6 can be found.

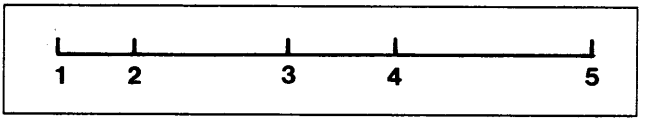

Figure 4.6: Scale values for the distances between the 5 stimuli in a one-dimensional representation

Scores differ for the four items. As we have seen in table 4.3 the four test items have different phonetic specifications in the tonic part. The data for the four items were therefore calculated separately and are presented in figure 4.7.

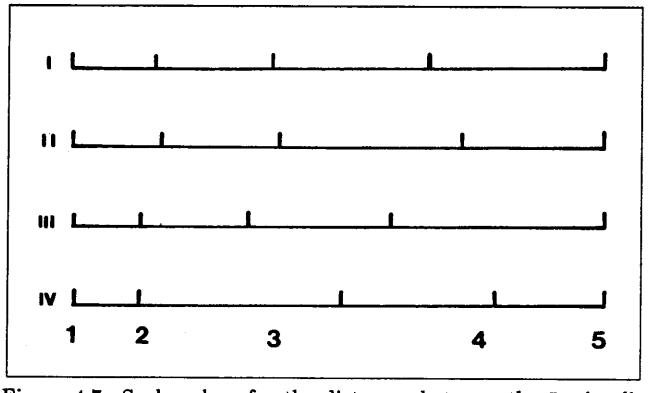

Figure 4.7: Scale values for the distances between the 5 stimuli for the four utterances

4.4.4 Conclusion and discussion

The questions that had to be answered can now be translated into terms of distances between the 5 stimuli: how large are the distances between the 5 stimuli?
Subjects indicated with a total score of 419 points (the maximum would be 480 points) for all four items that the distance between stimuli nos. 1-2 is small. The scores for stimuli nos. 3 and 4 are more difficult to interpret.
In item no. I the distance between stimuli 1 and 2 is small. The distance gradually grows between the other 3 stimuli. The only category is nos. 1-2.
In item no. II there are two categories: nos. 1-2 and a weak category nos. 4-5.
In item no. III the only category is nos. 1-2 (see also item no. I).
In item no. IV stimulus no. 3 does not know where to go to: there are two categories: nos. 1-2 and nos. 4-5. Stimulus no. 3 takes a middle position between nos. 1-2 and 4-5.
Generally speaking, the smallest distance in the four items is between nos. 1 and 2 or between nos. 1, 2 and 3, followed by nos. 4 and 5 (items nos. I, II and III). Stimuli nos. 1 and 2 form the only strong category in all four items.
In a translation of the results of the triadic experiment into terms of my classification of rising pitch accents with a middle posttonic part, the outcome can be interpreted as follows.
The subjects distinguished between all 5 stimuli. Yet they indicated to what degree differences between the stimuli were perceived. The difference between stimulus 1 and 2 is not the same as the difference between 1 and 3 or between 2 and 3, and so on. There is one strong category: stimuli nos. 1-2. In items II and IV there is a second category: stimuli nos. 4-5 or no. 5.
For my classification of rising pitch accents with high, low or middle posttonic part the outcome of the experiment means that a high level posttonic part or a slightly falling posttonic part belong together perceptually (1-2). The same holds true for low or almost low ((4-)5). I see no reason to introduce a further subdivision: the middle posttonic part has proved to be a *midfield* between high and low and not a middle level.
On the basis of the results I cannot define exact borderlines between high and middle and between middle and low, nor can the limits of perceptual tolerance for the middle posttonic part be described.

4.5 The classification experiment: rising pitch accents

The classification experiment was devised in order to answer some questions about rising pitch accents which still remained after the sorting experiment (section 4.2) and the writing test (section 4.3).

4.5.1 Problem

The results of the sorting experiment (see section 4.2) showed that one of the distinctive features of rising pitch accents with a large excursion is the posttonic part.
In the sorting experiment, rises with a middle posttonic part were classified according to the size of the excursion: large or normal. Rises with a large excursion reach their highest point *high* in the register (see section 5.2.1), those with normal excursion *low* in the register. In the sorting experiment the rises with posttonic parts other than middle all had a large excursion.
The experiment to be discussed now also includes normal excursion with posttonic parts other than middle.
In the corpus all rising pitch accents that occur high in the register also occur low in the register. In figure 4.8 rising pitch accents are given for both registers.

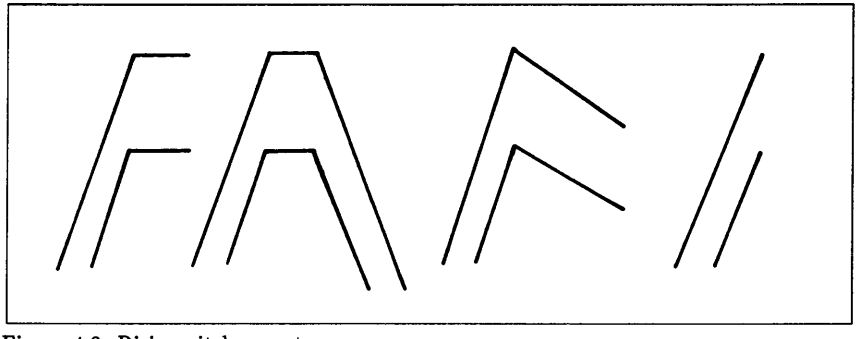

Figure 4.8: Rising pitch accents

As a result of the three experiments discussed in the previous sections I distinguish between three types of rising pitch accent high in the register (large excursion): early, steep and low; early, steep or gradual and high; early or late, steep or gradual and middle (see also section 5.6). Without posttonic part the difference between large, early and steep movements is in principle

neutralized (but see chapter 8 for individual cases). Rising pitch accents without posttonic part with a gradual slope belong to pitch accents with posttonic middle.

Questions we were left with after the sorting experiment were:

1. If subjects have to choose between similarity in the register and similarity in the posttonic part in rising pitch accents, then on the basis of which cue will they sort the accents: the register or posttonic part?
2. If register is a discrete feature, then: are rising pitch accents low in the register discretely different from one another in the same way as they are high in the register?

As to the first question, the results of the sorting experiment (section 4.2) had shown that subjects discriminated between rising pitch accents with a middle posttonic part on the basis of large and normal excursion. But what about the rises with posttonic low, high or ø (which in the sorting experiment all had a large excursion)?

I had answered the second question negatively beforehand on the basis of my perception. In the process of stylizing, the limits of perceptual tolerance low in the register were found to be large and F_0 curves were easy to stylize. I had made an exception for rises with normal excursion, early timing and low posttonic part, since in my perception this type of pitch accent was clearly different from the other types low in the register. If only this type of rising pitch accent differs from the others low in the register, then: is it discretely different from the same type with large excursion? Then do the other rising pitch accents with normal excursion belong to a single type? From my own experience I knew that low in the register the difference between rises with level and those with slightly falling posttonic parts is hardly perceptually noticeable.

As the sorting experiment (section 4.2) has shown, there is a perceptually relevant difference between the high and middle posttonic part in the case of pitch accents with large excursion. No such difference is indicated for accents with normal excursion: low in the register the difference between posttonic level and posttonic falling (middle) is hardly audible and thus not perceptually relevant. They are simply called *middle* (see figure 4.9).

Thus, a type of rising pitch accent with large excursion does not necessarily have a counterpart with normal excursion. So the only exception low in the register seemed to be rises with low posttonic parts, but probably only if two other conditions were present: a) an early timing, and b) after the rise, an immediate fall to the posttonic part.

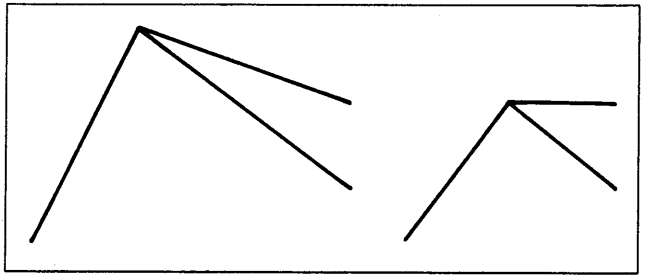

Figure 4.9: Middle posttonic parts after rising pitch accents

4.5.2 Experiment

The stimuli selected for the classification experiment consisted of rising pitch accents:
- with large excursion: posttonic low with steep slope; posttonic middle with steep and gradual slope;
- with normal excursion: posttonic low, timing early or late with steep or gradual slope ; posttonic level or falling (middle), timing early or late with steep or gradual slope.

The experiment was set up as follows. An item consisted of three stimuli: x, a and b, which were presented in the order
x-a
x-b.
The greatest similarity to x had to be indicated as follows: which of the two, stimulus a or stimulus b, is similar to stimulus x? Three such stimuli with stylized pitch movements are given in figure 4.10.

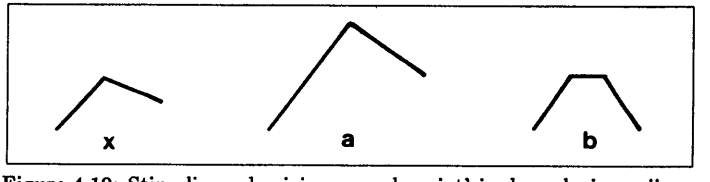

Figure 4.10: Stimuli x = kopiej, a = sochranjat'sja, b = sloeinversii

Stimuli a (*sochranjat'sja*) and b (*sloeinversii*) had to be compared to stimulus x (*kopiej*). The stimulus with greatest melodic similarity to stimulus x had to be marked in the written text.
The sets of two pairs of stimuli were recorded on tape. Every set of an x-a, x-b pair was repeated three times. Once would not have been enough, since

the stimuli were isolated from utterances and were sometimes no longer than two syllables. After a set a short pause followed in which subjects had to indicate the stimulus most similar to x.
The stimuli which were appropriate for the experiment were determined on the basis of stylized versions of original fragments. For the experiment itself, however, the original recordings were used, because the sound quality of the stylizations is always less than that of the original recording. The subjects were asked to concentrate on speech melody, that is I did not want them to be preoccupied with the understanding of words. Though the written text was also given on the score form, the sometimes short stimuli had to be immediately recognizable.
Six series were composed, selected from one female and three male voices from the corpus. In the experiment the sets within one series were given in random order, to avoid a so-called learning effect.
A series consisted of five sets of rises (for pictures see section 4.5.3):

1. x=normal/low	a=normal/steep/middle	b=large/low;
2. x=normal/steep/middle	a=large/steep/middle	b=normal/low;
3. x=normal/gradual/middle	a=large/gradual/middle	b=normal/low;
4. x=normal/low	a=normal/gradual/middle	b=large/low;
5. x=normal/steep/middle	a=normal/gradual/middle	b=normal/low.

Pitch accents with normal excursion and low posttonic part had varying timing and slope:

series I: early and gradual;
series II: late and gradual;
series III: early and gradual;
series IV: early and steep;
series V: early and gradual.
series VI: early and gradual.

The difference in excursion between large/low and normal/low varied from 3 to 8 semitones.
I would have preferred the normal/low accents to be all early and steep, but there were not enough of them in the corpus. On the other hand, different realizations made it possible to find out whether the posttonic low part alone was the feature distinguishing between this and other pitch accents low in the register, and whether normal/low was a separate type.

The outcome of the experiment was expected to show which features were the most important:
- if rises within one register (high or low) cluster, register overrules posttonic differences and slope;
- if rises within one register (high or low) do not cluster, posttonic differences overrule excursion (for slope see below).
In the fifth set the question was raised whether pitch accents with normal excursion and with low posttonic part are distinguished from other rises low in the register.
The feature slope is also involved, since high in the register rises are usually fairly steep, except for pitch accents with large excursion and middle posttonic part. Low in the register slope was not expected to be perceptually relevant.
Seven subjects, two males and five females, took the test at the Department of Phonetics of Leningrad State University. They were all highly trained listeners working in the interdisciplinary field of phonetics, linguistics and foreign language teaching at the department mentioned. The test was carried out individually, and followed by a short evaluation with me. Relevant remarks made by the subjects are given after the results.
In every series of five sets different realizations of pitch accents were presented. These differences have to be taken into account in the discussion of the results: for reasons that will be explained in section 4.5.3, the first two series (one female and one male voice from the same dialogue) were troublesome to judge for the subjects and for me; consequently, the judgments were hard to interpret.

4.5.3 Results

In table 4.6 the results of the experiment are presented for the five sets of series III-VI. As appeared after the experiment, some realizations in series I and II deviate from the other series and will therefore be dealt with separately. The total scores for the four series III-VI are given in the columns *register* and *posttonic part* for set 1-4, and *posttonic part* and *slope* for set 5. The total score for a set is 28: 7 subjects score 4 times for a or b.

4.5.4 Conclusion and discussion

In set 1 normal/low and normal/steep/middle are not really grouped together, but normal/low and large/low were matched even less often. In this set the proportion is 18:10 in favour of the register. Such an outcome only indicates a

set 1	register	posttonic
x=	a=	b=
total	18	10

set 2	posttonic	register
x=	a=	b=
total	18	10

set 3	posttonic	register
x=	a=	b=
total	13	15

set 4	register	posttonic
x=	a=	b=
total	22	6

set 5	posttonic	slope
x=	a=	b=
total	23	5

Table 4.6: Results of the classification experiment for rises in total scores of sets III-VI, with an indication of the similarity between stimuli x and a or x and b (register, posttonic part or slope) and with a stylized representation of stimuli x, a and b.

tendency to match pitch accents within one register (high or low) but it does not tell us whether there is a discrete difference between the two accents with normal excursion.

In set 2 the results show that subjects tend to match accents with the same posttonic middle part. In set 1 normal/low did not cluster significantly with normal/steep/middle. To this conclusion it can be added that large/steep/middle and normal/steep/middle are more similar to each other than normal/low and normal/steep/middle.

In set 1 the score for normal/low and large/low is as large as the score in set 2 for normal/low and normal/steep/middle. If pitch accents with large and normal excursion and middle and low posttonic parts are compared,

- the similarity of a low posttonic part in accents with large/low and normal/low seems to be less important than the similarity in excursion in accents with normal/low and normal/steep/middle (set 1);
- the similarity of excursion in accents with a normal/middle and normal/low seems to be less important than the similarity in the posttonic middle part in accents with large/steep/middle and normal/steep/middle (set 2).

A first careful conclusion can be drawn: the difference between large/low and normal/low is greater than the difference between large/middle and normal/middle.
In set 3 subjects were unable to choose between the register and posttonic part. The votes were almost equal. In series III and IV votes were in favour of the similarity in excursion; in series V and VI the similarity in the posttonic part was stronger. This can be explained from the phonetic data of the test items: in series III and IV the excursion of the large/gradual/middle accent was larger than in series V and VI.
In set 4 it again seems that normal/low and large/low do not belong to a single type: subjects have matched normal/low and normal/gradual/middle in a sufficiently convincing way.
Finally, in set 5, the subjects voted significantly for the similarity in the posttonic middle part. The type normal/low is separated from other accents low in the register.
Summarizing, the present experiment has shown that for the discrimination between accents with differences in posttonic parts and excursion, the feature *posttonic part* is a stronger cue than excursion if the posttonic part has a *middle* level. But *excursion* is a stronger cue for the discrimination between accents with differences in posttonic parts and excursion if the posttonic part is *low*.
Within one register the posttonic part overrules other differences between accents.
I therefore suggest that for the time being rising pitch accents with large and with normal excursion must be kept apart, for both the low and middle posttonic parts. But I do not exclude the possibility that no discrete borderline can be found between high and low in the register, that is, maybe large/low and normal/low will ultimately prove to be variants of a single type. The same holds true for large/middle and low/middle.
Further experiments must be devoted to this question.
The results have been explained for series III-VI in the experiment. I did not include series I and II for a number of reasons. There was a wide consensus among subjects about the first two series: they were considered to be very difficult to interpret. Subjects regarded series IV-VI as the easiest to classify and series III was more difficult. But what was wrong with series I and II?
In series I some stimuli were selected which on second thoughts were not good representatives of the type to be tested. The subjects confronted me with this shortcoming: the normal/low realization was too weak to be a good test

item. The subjects matched the normal/low with normal/middle in series I because the accents did not differ much perceptually. In series II the problem also consisted in the realization of the normal/low accent, which was not a good representative of the type I wanted to test. Furthermore, the subjects explained that the intonation of the speaker in series II was extremely difficult to interpret because of his drawling. The idea that weak realizations of types would also contribute to establishing differences between rising pitch accents proved to be a bad one.
From an experiment in which all stimuli within one type would have been manipulated into stimuli with identical phonetic specifications, we would probably have obtained a clearer picture about which of the two is stronger: the register or posttonic part. However, the present study attempts to give a description of the corpus with the original F_0 curves stylized, not standardized. This restricts the possibilities for experimentation. But as long as no melodic model has been developed, it seemed to me the best way of handling the problem of describing intonation in spontaneous speech. Classifying and describing spontaneous speech entails a lot of difficulties.

4.5.5 Six types of rising pitch accent

We can now complete the classification for the rises in the corpus. Since there is still no answer to the question of whether large/low and normal/low are variants of a single type and whether large/middle and normal/middle are variants of a single type, for the time being we will keep the four configurations separate from one another.
Figure 4.11 presents the six types of rising pitch accent.

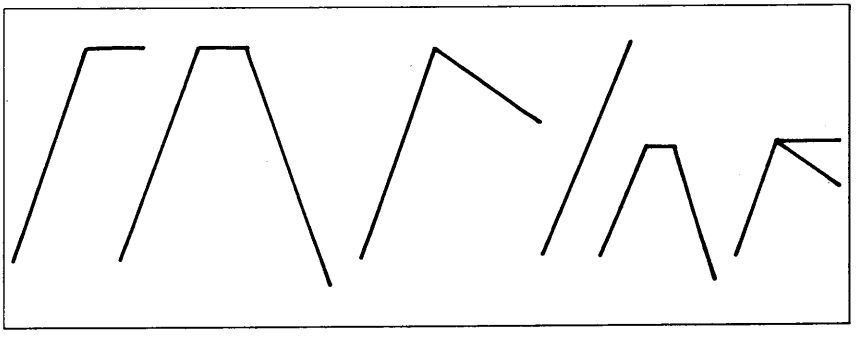

Figure 4.11: Six types of rising pitch accent

The tonic part of the pitch accent has to be described in terms of *rise* and

fall, whereas the posttonic part has to be described in terms of high and low *level* and middle *field*, that is, the point reached in the register.
The features of the six rises according to this description are presented in table 4.7.
Names are given according to the classification into types resulting from the perception experiments:

R = rise with large excursion,
r = rise with normal excursion,
l = low posttonic part,
h = high posttonic part,
ø = no posttonic part,
m = middle posttonic part,
- = early timing,
+ = late timing.

In the column "type" in table 4.7 the "old" names as given to types of rising pitch accent in sections 3.5, 4.2 and 4.3 are repeated between brackets in order to indicate how the old names of types of pitch accent correspond to the new names.

type	excursion	timing	slope	posttonic part
Rl- (C)	large	early	steep/ gradual	low
Rh- (E)	large	early	steep/ gradual	high
Rø-(F)	large	early	steep	ø
Rm- (H,I)	large	early	steep/ gradual	middle
Rm+/Rø+	large	late	gradual	middle/ø
rm- (H,I)	normal	early	steep/ gradual	middle
rm+	normal	late	gradual	middle
rl-	normal	early	steep/ gradual	low
rl+	normal	late	gradual	low

Table 4.7: Phonetic features of the six rises

Rising pitch accents high in the register with late timing and steep slope

hardly ever occur in my corpus. For gradual realizations of types Rl- and Rh- see chapters 5 and 8.
The final classification with names of pitch accents and phonetic specifications can be found in chapter 6.

4.6 The classification experiment: falling pitch accents

The classification experiment for falling pitch accents has been set up in order to find an answer to some questions that will be discussed in section 4.6.1. Falling pitch accents were found to exist with the phonetic features as given in table 4.8.

(pretonic part)	timing	slope	lowest level	posttonic part
(*zanos*)	early	steep	low	falling
	late	gradual	non-low	declination
			above non-low	level
				rising
				high
				ø

Table 4.8: Phonetic features of falling pitch accents

Before some types of falling accent with large excursion a *zanos* (see sections 3.5 and 5.5.2) may occur. A *zanos* is a set-up which provides the possibility of realizing a large excursion in the falling movement.
In table 4.9 names are given according to my classification:

F = fall,
l = low: the lowest level of the speaker is reached in the movement,
nl = non-low: the lowest level of the speaker is not reached in the movement,
h = high posttonic part,
f = fall within an utterance, not at a boundary, above non-low,
^{n} = the configuration is repeated,
\- = early timing,
\+ = late timing.

The combinations of phonetic features in a falling pitch accent were limited to the types listed in table 4.9. Note that the difference between types Fl-/Fnl-

and Fl+/Fnl+ is *timing*; unlike rising pitch accents, falling pitch accents can be discretely different from one another by just one cue: timing.
Differences in posttonic parts in falling pitch accents ending above non-low within an utterance are hardly audible.

type	excursion	timing	slope	lowest level	posttonic part
Fl- (A)	large/ normal	early	steep/ gradual	low	falling/ declination/ø
Fnl- (A)	large/ normal	early	steep/ gradual	non-low	falling/ declination/ø
Fl+ (B)	large	late	steep/ gradual	low	falling/ declination/ø
Fnl+ (B)	large	late	steep gradual	non-low	falling/ declination/ø
Fh- (D)	large/ normal	early	steep/ gradual	low/non-low	high+high level
F^n+ (G)	large	late	steep	low/non-low	high
f-/+ (J)	normal	early/ late	steep/ gradual	above non-low	varying

Table 4.9: Combinations of phonetic features in falling pitch accents

The falling pitch accents as found in the corpus are represented in figure 4.12. The aim of the present experiment was to verify this classification and to try to find a phonetic description for the so-called harmonica pattern (Odé 1986 and section 3.5).

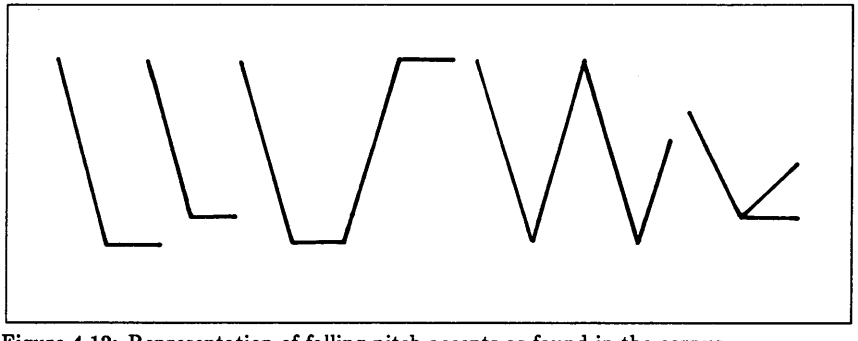

Figure 4.12: Representation of falling pitch accents as found in the corpus

4.6.1 Problem

My most important questions for the experiment, assuming that there is a discrete difference between early and late timing in falling pitch accents which reach the lowest level of the speaker, were:
1. Is there a discrete difference between falling accents which reach the lowest level of the speaker and those which do not (low vs. non-low)?
2. Is there a discrete difference between non-low falling accents with early and with late timing? If there is, is there a further difference between such accents in final position and in non-final position, that is, in the middle of an utterance or in the sawtooth pattern (Odé 1986; see section 3.5)?
3. Are falling pitch accents which reach the low or non-low level with late timing discriminated between on the basis of the size of excursion?
4. Is there a discrete difference between early and late, and between low vs. non-low in falling accents with a rising posttonic part?
5. Falling accents in the harmonica pattern are connected with the next accent by a rising posttonic part immediately after the lowest point. The rise is followed by a pretonic *zanos*. Nearly every syllable with lexical stress has a pitch accent in this pattern.
Is there a difference between the falling accents in the harmonica pattern and other falling accents with a rising posttonic part? If not, which feature(s) cause(s) the harmonica effect? Is one pitch accent enough to recognize the harmonica pattern?

4.6.2 Experiment

The experiment was divided into three different tests with the same stimuli, which were selected from stylized realizations of all types of falling accent that occur in the corpus (see table 4.9).
The 62 stimuli (spoken by two female and five male voices) consisting of one or two words, were presented on tape in the original recording. The same subjects (see section 4.5.2) took the first and second tests.
In test 1 all stimuli were recorded once with a short pause between them. The task was to indicate in the written text which came with the test where a shift takes place from one type to another type between two stimuli. In the first test the shifts between the stimuli were as follows (according to my classification):
late/non-low - late/low - early/non-low - early/low - late/low - early/low - early/non-low - early or late/above non-low - early or late/high - harmonica

- late/non-low - late/low - late/non-low - early/non-low - early or late/above non-low - early/non-low.
I expected test 1 to be extremely difficult, especially with different voices in subsequent stimuli (see section 4.6.4), but it seemed useful to me to verify whether some of the shifts were audible at all.
In the second test the same stimuli appeared in the same order, but now in pairs. In the order in which the stimuli in test 2 were presented it was expected that a shift from one type to another occurs between pairs and within pairs. A pair (one pair - one voice) consisted of two falling accents of the same type (similar pair) or of two different types (dissimilar pair). In the dissimilar pairs the types differed in timing, in the lowest point reached and/or in the posttonic part.
Subjects had to indicate melodic similarity or dissimilarity of each pair in the written text.
The third test was performed by another group of 9 trained listeners, all postgraduate phoneticians or linguists. Their task was to listen to the stimuli as recorded in the first test but with a longer pause between them and to choose an appropriate punctuation mark. The words were printed with enough space left to write down punctuation marks. Subjects had to choose between the five following marks:
. , ... ! ?
The mark ... had to be used after falling accents that seemed to them to be realized in non-final position, within an utterance, in an abruptly broken-off phrase.
It has to be noted that the comma and the exclamation mark are frequently used in Russian. In contrast to English and Dutch, commas in Russian are used before practically every clause.
Exclamation marks are frequently used after utterances with a more or less emphatic accent.

4.6.3 Results

For a better understanding of the results, the data for test 2 are presented first.
According to my phonetic classification there were 18 pairs with melodic similarity and 13 pairs with melodic dissimilarity.
With 7 subjects the maximum score for a similar or dissimilar pair was +7 or -7, respectively. The maximum score for 18 similar pairs for 7 subjects was

18x7 = 126. The maximum score for 13 dissimilar pairs for 7 subjects was 13x7 = 91. The results of test 2 are:
- for similar pairs a score of 91 out of a maximum of 126 (18x7) = 72%,
- for dissimilar pairs a score of 75 out of a maximum of 91 (13x7) = 82%.
According to a χ^2 test these results are highly significant: p = < .005.
The subjects did indeed differentiate between similar and dissimilar pairs according to my classification. It is not surprising that the dissimilar pairs show a higher percentage than the similar pairs, since two realizations of one type of pitch accent are always slightly different. It was a great advantage to work with the group of highly trained listeners for the first two tests. They were conscious of the difficulty of classifying speech phenomena. They were also familiar with the notion of *perceptual equivalence* (see section 3.4) and knew what they had to listen to.
There are differences in the scores for individual types of falling pitch accent. The percentages for the similar pairs are listed below. Again a maximum score for one similar pair is +7. The score is given per type of falling accent for the number of similar pairs of that type.

Fl-	early/low	(3 pairs: 16 out of a maximum of 21)	76%;
Fnl-	early/non-low	(2 pairs: 11 out of a maximum of 14)	79%;
Fl+	late/low:	(3 pairs: 18 out of a maximum of 21)	86%;
Fnl+	late/non-low	(2 pairs: 12 out of a maximum of 14)	86%;
Fh-	early, late/high	(3 pairs: 13 out of a maximum of 21)	62%;
f-/+	early, late/ above non-low	(3 pairs: 13 out of a maximum of 21)	62%;
F^n+	late/high	(2 pairs: 8 out of a maximum of 14)	57%.

The score for Fl- is lowered by the fact that one stimulus of one pair was perceived as an emphatic accent (it has a small *zanos*) and was therefore indicated by 4 subjects as being different from the more neutral partner of the pair.

In the first test, the subjects had indicated where a shift was heard from one type to another type between two stimuli. According to my classification, such shifts occurred between pairs and within pairs. In half of the 18 similar pairs a shift in type was marked by one or two subjects in the first test of the experiment. A correlation between the first test (shift marking) and the second test (similarity/dissimilarity) can only be given partly, since the first

test was different from the second test in the presentation of the stimuli. Moreover, there was frequently a change of voices too. Some subjects told me afterwards that they had marked a shift at almost every change of voice. Obviously, in marking shifts the subjects used different perceptual criteria. It was very challenging, though, to try to find a correlation between shifts marked within a pair and the pairs marked as dissimilar, since no dissimilar pair ever missed a shift mark.

The number of subjects who voted for similarity minus dissimilarity in 31 pairs is shown on the x-axis in figure 4.13. For 7 subjects the theoretically possible extreme values are +7 (7 subjects voted for similarity) and -7 (7 subjects voted for dissimilarity). The number of shift marks actually found is indicated on the y-axis. The highest score was 5.

The straight line in figure 4.13, the regression line, has a slope of -0.653 (direction coefficient) with an intersection at 4.2 on the y-axis.

The correlation between dissimilarity and shift marks is significantly high ($r = 0.837$), despite the fact that not all shift marks (those between pairs) could be taken into account.

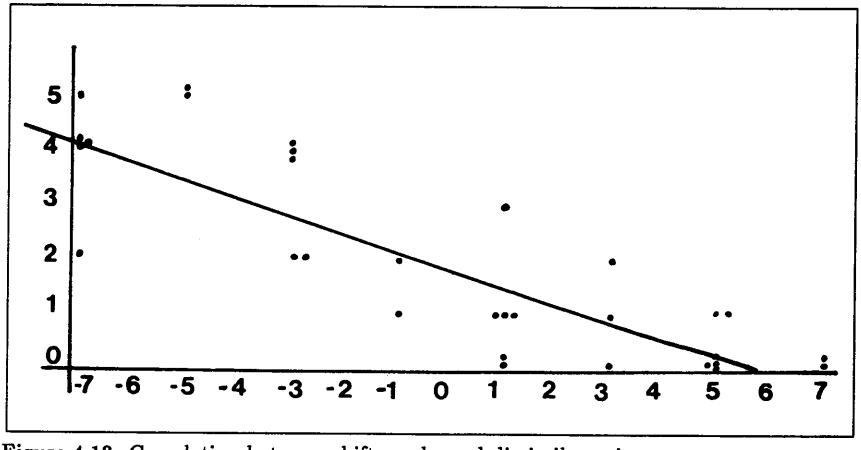

Figure 4.13: Correlation between shift marks and dissimilar pairs

A correlation between the first or second test and the third test cannot be given since the third test, the marking of punctuation marks, differs in its device from the first two tests.

It is, however, interesting to see how far the two groups "agree" in their judgments about positions in which the falling accents occur in an utterance. The results from the third test are listed in table 4.10. Note that for 9

subjects the total score is 9 marks per stimulus, but some subjects did not write punctuation marks for all stimuli.
The number of stimuli per type is indicated in the first column in table 4.10.

stimuli	type	.	!	,	?	...
10x	Fl-	54x	3x	15x	2x	10x
10x	Fnl-	56x	4x	10x	2x	14x
8x	Fl+	41x	10x	7x	1x	8x
6x	Fnl+	32x	1x	10x	0x	11x
10x	f-/+	25x	0x	27x	1x	41x
10x	Fh-	14x	4x	18x	24x	25x
8x	F^n+	30x	2x	11x	12x	15x

Table 4.10: Number of punctuation marks as indicated by 9 subjects for 62 stimuli

The test gives some indication about functional differences between the seven types, but it is clear that these differences must be investigated further: they cannot be described simply in terms of punctuation marks.

4.6.4 Conclusion and discussion

For the three tests I had selected stimuli which, according to my classification, belong to different types of falling pitch accent. The subjects discriminated between types with sufficiently high significance: the percentages for similar and for dissimilar pairs, as well as the correlation between dissimilar pairs and shift marks, give evidence for the correctness of my classification.
However, the subjects were not asked to sort stimuli. And what we would also like to know is whether stimuli selected by me as realizations of one type actually *are* of one type. All 62 stimuli were taken from the seven types I had found (see section 4.6).
Generally speaking, the results show that every time a stimulus from a type X was presented, it was indicated as similar to another stimulus of type X or as dissimilar to a stimulus of type Y. But the percentages for similar types of stimuli are different for the seven types (see section 4.6.3). On the basis of those results we may conclude that discretely different types are Fl-, Fnl-, Fl+ and Fnl+, which confirms my classification.
Less significant are the results for three other types in my classification: types f-/+, Fh- and F^n+. Subjects were not consistent in their judgments about these types. Obviously, the stimuli of these 3 types were difficult to interpret.

Conclusions from the results of the three tests will be drawn by answering the 5 questions about falling pitch accents formulated in section 4.6.1.
The first question has been answered positively in the tests: there is a discrete difference between falling pitch accents which reach and falling pitch accents which do not reach the lowest level of a speaker. The classification of F- and F+ into low and non-low is, then, correct. However, the third test (see table 4.10) does not give any evidence about whether there is a discrete functional difference between low and non-low for types F- and F+ (see section 5.2.3); and if there is, what does the difference consist in?
The second question concerned the difference between Fnl-, Fnl+ and f-/+. The results show that f-/+ is indeed a discretely different type. In pairs where Fnl-, Fnl+ and f-/+ were presented in contrast, subjects discriminated between them.
Another question is how type f-/+ must be described phonetically. There was not much consensus between subjects about this type in similar pairs. The stimuli were isolated from utterances, and pitch movements which are isolated from the *middle* of an utterance, not at a boundary, are always difficult to interpret. Depending on the intonational continuation of an utterance, posttonic parts after a type f-/+ realization differ considerably, which makes them all the more difficult to classify.
In the future a further sorting experiment will have to be devoted to types Fnl+, Fnl- and f-/+, on the basis of which a more detailed description of type f-/+ can then be given.
The third question, about the size of excursion for F+ accents, can be answered negatively. The 13 stimuli of types Fl+ and Fnl+ have a large excursion in 8 stimuli and an excursion of about 10 semitones in the other 5 stimuli. The stimuli are not discriminated between on the basis of the size of excursion. A *zanos* occurs in 12 of the 13 stimuli. In our examples type F+ has, on the whole, a large excursion and realizations occur frequently with a *zanos*. Test three confirms this description: type Fl+ realizations had the highest percentage of exclamation marks.
We are left with some problems that require further research: questions 4 and 5 about falling accents with a high posttonic part and about accents in the harmonica pattern can only partly be answered.
Falling accents with a high posttonic part were discriminated from falling accents with other posttonic parts (non-low, low, level). But within this type, Fh-, the subjects indicated differences. There were not many realizations of this type in my corpus. This does not mean that the type rarely occurs (see

also section 5.6). I prefer not to answer questions about this type as yet. On the other hand, it is one of the most clear configurations of pitch movements in Russian intonation. I have simply been hampered by a lack of examples. I can only steer on my own compass in order to describe the differences between type Fh- and the harmonica pattern, F^n+, because of the lack of examples. Type F^n+ also has a high posttonic part. The last question concerns type F^n+.

As the name of this type indicates, F^n+ is a repeated realization of type F+. It has a posttonic part that rises till the subsequent *zanos* preceding the next falling pitch accent is reached. The last realization in the sequence also rises in the posttonic part, but not as high as type Fh- and not continuing on a high level. Type F^n+ differs from Fl+ in its posttonic part.

type	pretonic part	tonic part	posttonic part	next syllable(s)
Fl+/Fnl +	(*zanos*)	large or normal late low or non-low	low	ø
Fh-	varying	large or normal early non-low or low	high	high level
F^n+	*zanos*	large late non-low or low	high	*zanos* or ø

Table 4.11: Phonetic specifications of types Fl+, Fh- and F^n+

In table 4.11 the three types are contrasted as to their phonetic specification. If we cut off the posttonic part of Fh- and F^n+ we are only left with differences in the pretonic part and in timing: Fh- would now belong to Fl- and F^n+ to Fl+ or Fnl+. This suggestion must be verified in a future perception experiment.

In the results harmonicas were indicated as being similar by 3 or 4 out of 7 subjects. However, shift marks did not always occur if a difference was heard. Subjects were not consistent in their perception of the harmonica. One realization, which differed most from the others melodically according to the results, was perceived by 7 (out of 9) subjects as a question in the third test. Summarizing, I would like to outline the present state of the description for the 7 phonetically different types of falling pitch accent as follows:

- Further perception experiments are needed in order to describe types Fh- and F^n+.
- Differences between realizations of f-/+ were indicated by the subjects. But I believe that there exists only one type of falling pitch accent with normal excursion, with varying timing and posttonic parts, which does not reach the non-low reference level as the lowest point.
It occurs mainly in the middle of an utterance and in the sawtooth pattern, not at a boundary.
- Types Fl-, Fnl-, Fl+ and Fnl+ have been established. If future experiments about the function of these 4 types show that there is (as I expect) no discrete functional difference between low and non-low for these types, they can simply be described as F- and F+.

Chapter 5

Perceptually relevant features of Russian pitch movements

5.1 Introduction

In this chapter the perceptually relevant features of Russian pitch movements will be described on the basis of the classification and the outcome of the perception experiments described in chapters 3 and 4.
In the present chapter the descriptions of perceptually relevant features apply to Russian spontaneous and prepared speech, though the descriptions may equally well correspond to perceptually relevant features of pitch movements in other languages. The aim of describing perceptually relevant features of Russian pitch movements is to clarify the use of terms which are indispensable for a perceptual description of intonation and which are not always self-evident.

5.2 Excursion

The *excursion* of a perceptually relevant pitch movement indicates the size of an interval. The begin and end frequency of an excursion is usually given in hertz if the absolute pitch level has to be indicated. The excursion is presented in semitones if the size has to be given relative to other excursions. Data in hertz show the exact point in the fundamental frequency domain, whereas data in semitones give no information about this point.
The *actual* excursion is measured from the begin frequency to the end frequency in a given perceptually relevant pitch movement. Excursion is also measured from the end frequency of the movement to the lowest frequency of a given speaker, because movements with perceptually the same excursion are movements which reach the same end frequency in semitones relative to the

lowest level (see section 5.2.2). The highest and lowest frequencies indicate the register in which pitch moves. The range of the register is speaker-specific. First, the register and the reason for measuring the excursion from two different levels will be discussed in sections 5.2.1 and 5.2.2.

5.2.1 Register

The register of a speaker or singer is the melodic range within which pitch moves on a scale between high and low. The register is usually divided into three modes: the vocal fry, the modal register and the falsetto (Hess 1983). Other names for vocal fry and falsetto can be found in the literature.
According to Hollien (1972), the modal register is acoustically and physiologically well described and identified on the perceptual level. Since in the data of the corpus almost all pitch movements are in the modal register, the other registers will not be discussed here. The modal register "(...) includes the range of fundamental frequencies that are normally used in speaking (...)" (Hollien 1974: 126). For male voices the modal register has a range of 75-500 hertz, and for female voices 130-750 hertz (Hollien 1974: 130).
In some of the fragments of the corpus there are examples of pitch movements which end in the vocal fry. The acoustic characteristics of speech produced in the vocal fry are probably responsible for the fact that it is sometimes very hard to stylize pitch in this register, though the pitch level can be perceived very well.
For the present research the modal register (henceforth: register) is established for each speaker with a further subdivision into high and low, on the basis of the perceptually relevant pitch movements in the corpus. This subdivision is necessary because there is a difference between rises which have their highest point high in the register and those with their highest point low in the register. But there is no audible breakpoint between high and low in the register in the voice quality.
A hearer can give a correct indication of the position in the register where the voice of a speaker is situated, despite the fact that the range varies with each speaker. A few utterances, maybe even a few seconds of speech, spoken by an unknown voice, seem to be enough to establish the register of the speaker. To my knowledge there is no experimental evidence for this phenomenon, though a certain degree of consensus about it appears to exist among phoneticians.
Summarizing, in my classification the register of a speaker is the melodic range within the modal register in which pitch moves. Roughly speaking, the

register covers the range within the modal register from the lowest level up to about 10 semitones (low in the register, normal excursion) and from about 10 semitones above the lowest level to the highest level (high in the register, large excursion), which varies up to 23 semitones for each speaker.

5.2.2 Actual and relative excursion

In the specification of phonetic data for every speaker (chapter 8) the excursion is given in semitones.
Two movements of two different speakers cannot be compared with each other on the basis of data indicated in hertz. On the other hand, if data are given in semitones of only the actual excursion, we do not know where the end frequency of the excursion in the movement is situated in the register.
For a pure comparison of the excursions of two movements, two different sorts of data must therefore be known: the excursion of the actual movement and the location of the movement with respect to the lowest level of a given speaker. In the perception of pitch, listeners actually do the same: the lowest level of a speaker is always virtually present at any moment of speech as a reference level.
For example, a rise with a begin frequency of 110 hertz and an end frequency of 184 hertz has an excursion with a size of 9 semitones. In the example the size of the actual excursion of the rise is 9 semitones, but if the lowest level of a speaker is, say, 65 hertz, the rise starts 9 semitones above 65 hertz. Measured from the lowest level the excursion is 18 semitones. This is a fairly large excursion, with an end frequency high in the register. The perceptually relevant rise has thus started at a level that lies about 9 semitones above the lowest level of the given speaker.
The excursion has not been measured from a declination line, since in the corpus declination is observed only incidentally. The perception experiments do not show that the excursion of pitch accents is perceived with respect to a declination line. See also section 5.4.1.
A falling movement with an actual excursion of, say, 8 semitones which reaches the lowest level of the given speaker is not the same as a falling movement with an actual excursion of 8 semitones which does not reach the lowest level of that speaker: the two movements belong to different types of pitch accent. Rising and falling pitch movements ending in different positions in the register are presented in figure 5.1.
The first rise has an actual excursion of 9 semitones measured from the lowest

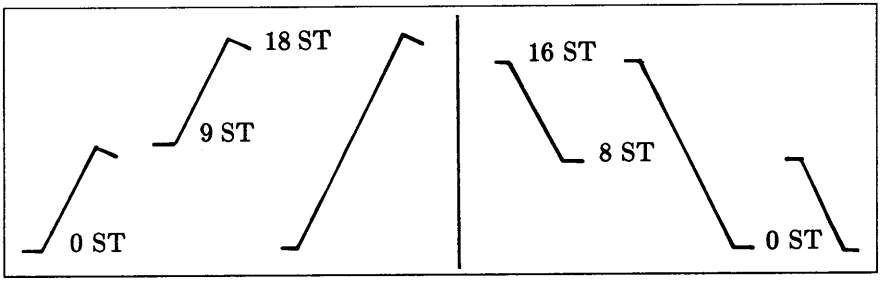

Figure 5.1: Rising and falling pitch movements high and low in the register

level. The second rise has an actual excursion of 9 semitones measured from the begin frequency of that rise. The third rise has an actual excursion of 18 semitones measured from the lowest level. The first rise ends low in the register, the second and third rise end high in the register. Nos. 2 and 3 are perceptually equivalent and cluster.
The first fall with an actual excursion of 8 semitones does not reach the lowest level; the second fall has an actual excursion of 16 semitones and reaches the lowest level, the third fall has an actual excursion of 8 semitones and reaches the lowest level. The second and third fall both reach the lowest level: they are perceptually equivalent and cluster despite their different actual excursion.
Finally, it would be wrong to call an excursion *small* in contrast to *large*: in my classification pitch accents with a *normal* excursion have an interval of up to 10 semitones, which is not particularly small in e.g. Dutch, but normal in Russian. The indication *small* suggests a smaller size.

5.2.3 Reference levels for rising and falling pitch movements

The reference levels for rising and falling pitch movements are defined on the basis of the register.
With the low reference level I indicate the lowest level of a given speaker, that is, the lowest frequency measured in types Fl- and Fl+. Exceptions made by a given speaker, such as falling movements ending in the vocal fry, far below the lowest level in other falling movements, are disregarded in determining the low reference level.
With the high reference level I indicate the highest level of a given speaker, that is, the highest end frequency measured in rising movements. Again, exceptional cases were not used for the definition of the high reference level.

The borderline dividing the register into high and low is drawn between the high and low reference levels. This borderline varies for each speaker. In figure 5.2 this line is therefore dashed.

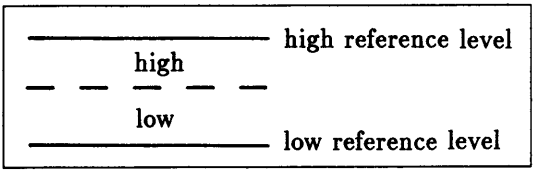

Figure 5.2: Reference levels for rising and falling pitch accents

In the overview with averaged phonetic data of types of pitch accent (chapter 6) we will see that rising pitch accents ending high in the register often have an early timing and a steep slope. Low in the register rising pitch accents occur in all possible combinations of timing and slope.
In the process of stylizing rising F_0 curves it was observed that great precision with respect to timing and slope was required high in the register. Low in the register the limits of tolerance within parameters, in the process of stylizing, were considerable.

5.3 Timing

Timing indicates the position at which the highest point for rises and the lowest point for falls is reached with respect to the vowel onset of the accented syllable. In order to find the vowel onset in the accented syllable the gain and amplitude (see fig. 2.2 in section 2.3.3), synchronically displayed on the monitor, are used. An operational way of perceptually determining vowel onsets is as follows. By listening to a previous or following fragment of some tens of milliseconds at intervals of 10 milliseconds forward or backward, and by looking at the gain and waveform displayed on the screen, I decided I had found the vowel onset:
- where the preceding consonant was no longer clearly audible, and
- where the vowel in isolation perceptually had not lost any of its quality as compared with the vowel in its phonetic context.

In the corpus in part II the vowel onset is indicated with a dash on top of the stylized contour (see chapter 7). In the F_0 curve we can now see to what extent the pitch movement is completed at the vowel onset.

5.3.1 Early and late timing

If the highest point of a rise is reached *near* the vowel onset, i.e. the rise takes place *before* the vowel onset, the timing is called *early*. If the highest point of a rise is reached *near the end* of the accented vowel, i.e. much later than the vowel onset, the timing is called *late*. If the vowel onset is in the middle of a rising pitch movement, the movement can be manipulated and shifted forward or backward in order to find out whether the timing is perceived as *early* or *late*, by listening to and comparing the manipulation with the original. Early and late timing are determined for falling pitch movements in the same way. The timing in falling pitch movements is called *early* if the lowest point of the fall is reached *near* the vowel onset, i.e. the fall took place *before* the vowel onset. The timing in falling pitch movements is called *late* if the lowest point is reached *near the end* of the accented vowel, i.e. *much later* than near the vowel onset. Figure 5.3 shows early and late timing for rising and falling pitch movements. The dash indicates the vowel onset. It should be noticed that the exact location of movements, both with early and with late timing, may vary: it depends, for example, on the type of consonant (Hill and Reid 1977). Therefore, data as to the duration of (part of) the accented vowel before, near or after the end frequency of a pitch movement are not given. For all accents it has been determined perceptually whether timing was early or late.

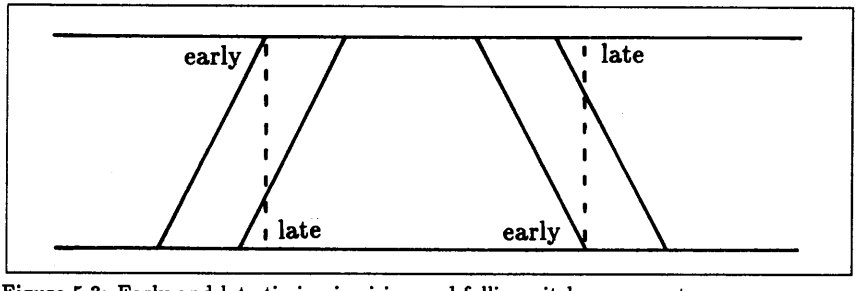

Figure 5.3: Early and late timing in rising and falling pitch movements

As a distinctive feature for the perception of pitch accents, timing has been discussed in chapter 4. It is the only feature that distinguishes between the falling accents Fl-, Fnl- and Fl+, Fnl+.

5.4 Duration and slope

It seems that the *duration* of pitch movements is not an independent distinctive feature in Russian intonation, in the sense that pitch accents are distinguished on the basis of duration alone.
The duration of a perceptually relevant pitch movement is usually indicated in terms of milliseconds measured from the beginning of the perceptually relevant pitch movement till the end. The duration of a perceptually relevant pitch movement, together with excursion, establishes the slope of a movement: by determining the duration and the actual excursion in the perceptually relevant pitch movement the slope can be calculated in terms of semitones per second.
I call a slope *gradual* at a value of about 70 semitones per second or less and *steep* at a value of about 70 semitones per second or more (figure 5.4), but values for steep or gradual slope vary considerably among speakers. Varying values are given in chapter 6.

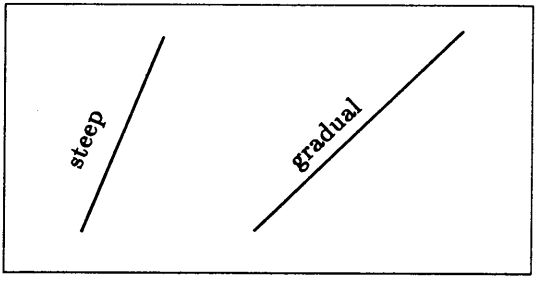

Figure 5.4: Steep and gradual slope

Slope is not an independent distinctive feature in Russian intonation. However, in combination with timing and/or the posttonic part it can be significant for the differentiation of types of pitch accent. For instance, type Rh-, which usually occurs with *early* timing and *steep* slope, may also occur with early timing and *gradual* slope. With gradual slope the high posttonic part continues on the high level reached in the tonic part without any declination (see section 4.2 and 5.6.2). But if the posttonic part is high, the timing *late* and the slope *gradual*, the movement is a type Rm+ realization. So slope alone is not a distinctive feature. In figure 5.5 an example is given of two realizations of Rh- and one realization of Rm+. The vertical dash indicates the vowel onset.
A further characteristic of slope is its property of lending emphasis. If a

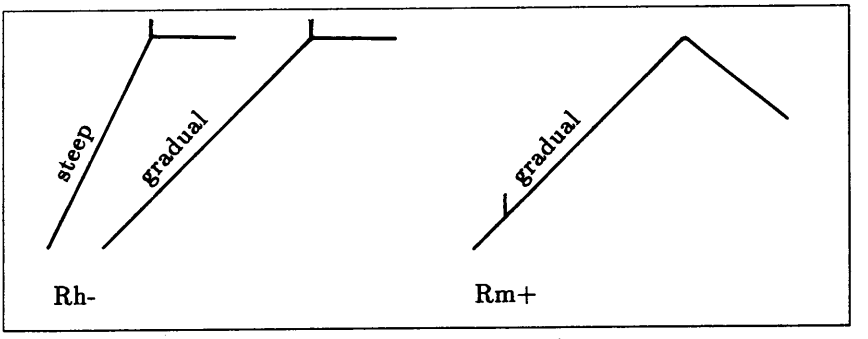

Figure 5.5: Two realizations of Rh- and one realization of Rm+

movement has a large excursion, late timing but a steep slope the syllable will be perceived as more salient than if the slope of the movement were gradual. An example is stimulus no. 19 in the sorting experiment (section 4.2).
If in a falling pitch accent Fl+ the actual fall starts much later than the vowel onset and the slope is steep, the pitch accent is more emphatic than if the slope were gradual. An example is given in figure 5.6.

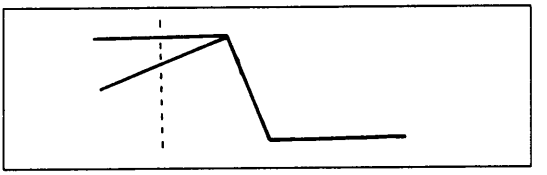

Figure 5.6: A steep slope lending emphasis in a type Fl+ realization (the dashed line indicates the vowel onset)

The slope in a gradually falling or rising movement must not be confused with the slope of, respectively, *declination* and *inclination* over a number of syllables in an utterance (see section 5.4.1).

5.4.1 Declination and inclination

Slope has been described as one of the phonetic features in perceptually relevant pitch movements. The perceptually relevant pitch movements are connected by non-prominence lending pitch movements if no melodic boundary, pause (see section 5.7) or reset (see section 5.4.2) occurs. Depending on the type of pitch accent, pitch falls or rises over a number of unaccented syllables to the next pitch accent. If the posttonic part after a pitch accent is a distinc-

tive feature of the realized type, pitch moves from that part to the next pitch accent or to the pretonic part of the next pitch accent (see section 5.6.4). The slope in the connecting non-prominence lending pitch movements depends on the number of syllables between two pitch accents, on the turning point in the connecting non-prominence lending pitch movements (see section 5.6.4) and sometimes on the occurrence of microintonation.

However, there are other phenomena that influence the slope of movements over a number of unaccented syllables in an utterance.

As in other languages (i.e. English, Dutch, German) in Russian it has been observed that fundamental frequency tends to decline in the course of an utterance. This well-known phenomenon, called *declination*, has been widely discussed in the literature on intonation, so the discussion will not be repeated here. My description of declination is based upon 't Hart, Collier, and Cohen (forthcoming).

In the course of an utterance the subglottal pressure P_s decreases. The decrease of P_s is a physiologically determined phenomenon. With the decrease of P_s, the rate of which can be controlled by the speaker, the F_0 declines. For longer utterances the decrease will be slower than in shorter utterances: the speaker influences the slope of declination, that is, declination can be restrained. In connecting non-prominence lending movements F_0 declines by itself and the speaker controls the extent of this decline, depending on the length of the utterance.

Non-prominence lending movements that are rising have another physiological nature: *inclination*. Inclination, unlike declination, is a voluntary physiologically determined phenomenon.

In order to make pitch rise or fall, the laryngeal muscle *cricothyroid* (CT) contracts or relaxes. As the CT activity increases, pitch rises; continued activity keeps pitch high; as the CT activity decreases, pitch falls (Collier 1975).

The subglottal pressure decreases in the course of an utterance in falling movements as well as in rising movements. But, roughly speaking, by overruling the P_s decrease by means of sufficient CT contraction a speaker achieves rising movements. As the CT relaxes pitch falls again; the relaxation of the CT contributes to the decline of F_0. This phenomenon is discussed in Collier (1987).

Declination has been described as the tendency of F_0 to float down gradually over the course of an utterance. In spontaneous speech, however, declination is not always found (e.g. Umeda 1982). In the corpus, declination is indeed absent in large parts of the excerpts in spontaneous speech. Moreover, it

is also often absent in prepared speech. The absence of declination in large parts of the corpus and other evidence from the perception experiments do not justify a description of pitch accents as superposed on a declination line. At a glance it can be seen that in the speech of, for instance, Vysockij (see chapter 10), declination is almost absent. In the two examples in figure 5.7 the difference between utterances which show declination and those that do not is clearly visible.

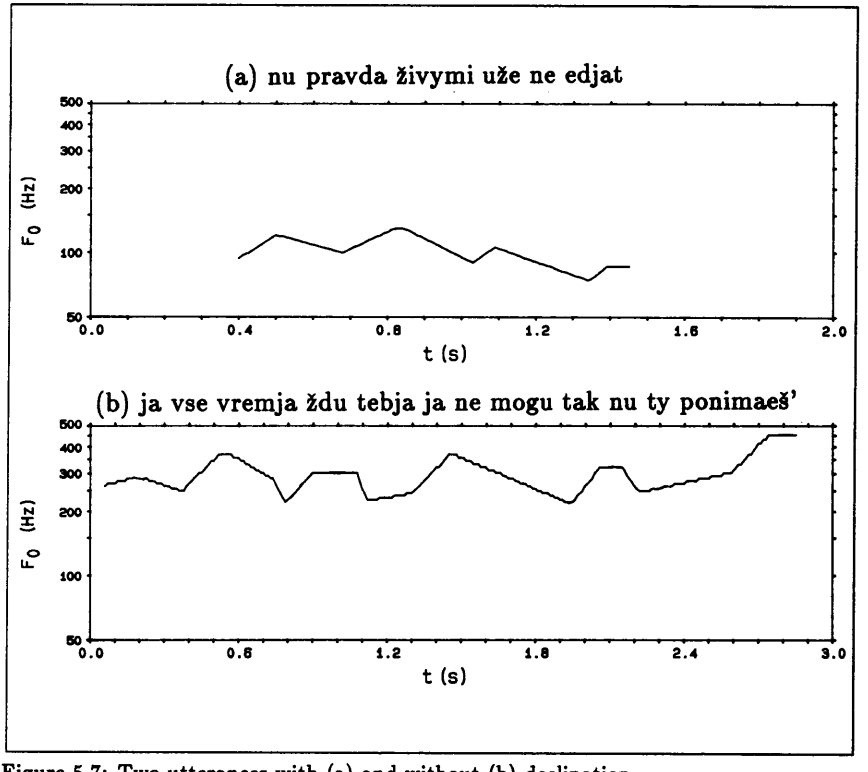

Figure 5.7: Two utterances with (a) and without (b) declination

An interesting issue is whether there is any correlation in spontaneous speech between the tendency never to reach the low reference level in order to keep the hearer listening and the absence of declination. Though an important question, it was beyond the scope of this book.

5.4.2 Reset

In an utterance an upward or downward jump in F_0 is frequently observed. The pitch movement is broken off and a new (sequence of) pitch movement(s) starts at another pitch level. The two movements are not connected in the way described in section 5.4.1. For such a jump, which is called *declination reset* or simply *reset*, no degrees of slope are given, since a reset is not a movement. Resets occur frequently in the corpus.

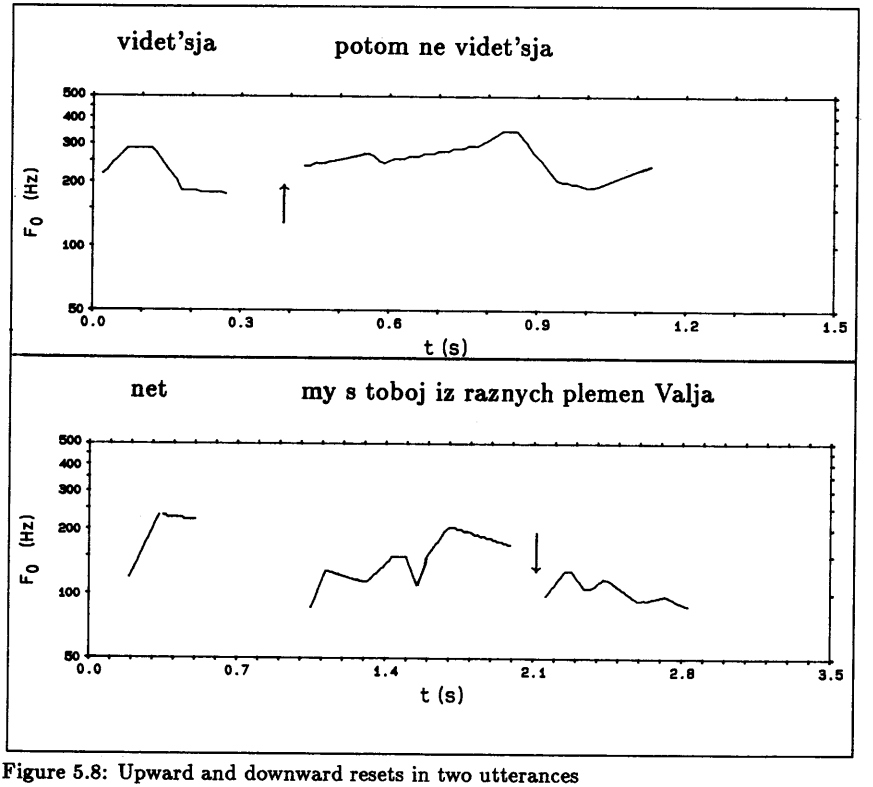

Figure 5.8: Upward and downward resets in two utterances

An upward reset is realized in various positions. For instance, if a speaker has reached a low level too early, a reset is needed. In spontaneous speech a reset often occurs in elliptic utterances, after humming and hawing or after hesitations. In the middle of an utterance, e.g. when the speaker suddenly remembers something, a reset can also be found.
A reset occurs downward, for instance, when a speaker says something "be-

tween brackets". In afterthoughts and in parentheses the same downward reset can be observed. After brackets, an afterthought or a parenthesis an upward reset will follow again. Pitch movements in a parenthesis or in an afterthought are usually realized in a reduced span.
In figure 5.8 an upward and a downward reset are presented. The resets are indicated with an arrow.

5.5 Pretonic movements

5.5.1 Perceptually relevant pretonic movements

Pitch movements in pretonic syllables affect the perception of pitch movements in a number of ways.
For example, a pitch movement in the tonic syllable can be a continuation of a movement in the pretonic syllable. If the pitch movement is perceived as taking place entirely in the tonic syllable, the pretonic and tonic syllables must be considered together as one perceptually relevant unit (see fig. 5.9). More examples can be found in section 3.2.

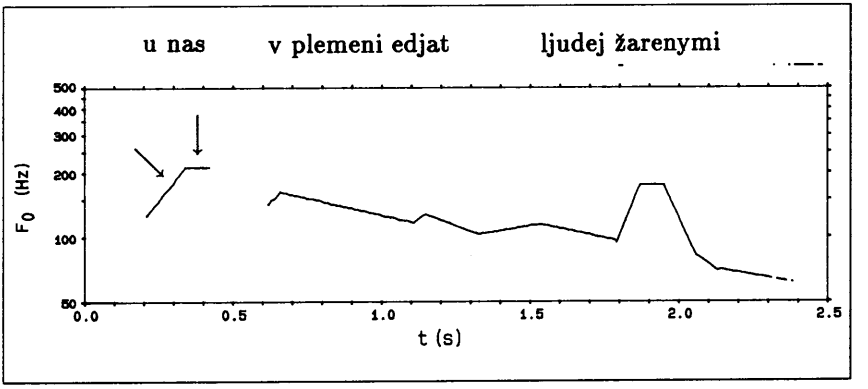

Figure 5.9: A pitch accent realized in the pretonic and tonic syllables

Pitch movements which take place either in the pretonic or in the tonic syllable, or in both, and which are perceptually equivalent, are classified as one type of pitch accent.
If the direction of the pitch movement in the pretonic syllable is different from that in the tonic syllable, the pitch movement in the pretonic syllable makes the pitch movement in the tonic syllable more salient. An example is presented in figure 5.10.

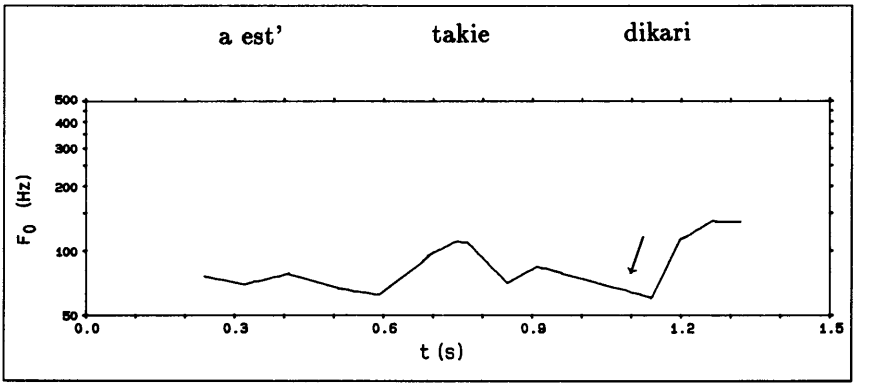

Figure 5.10: A pretonic movement which makes the tonic movement more salient

5.5.2 The *zanos*

Within the category of pretonic movements the *zanos* (Kuznecova 1960: 47) has a special place. A *zanos* is a small and usually steep rise in the pretonic syllable, a set-up (up-beat) before a fall, which provides the possibility of realizing a large excursion in the falling pitch movement (see fig. 5.11).

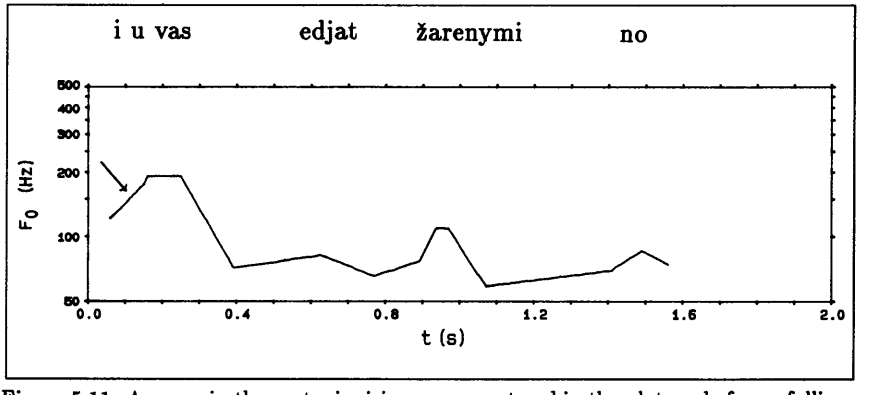

Figure 5.11: A *zanos* in the pretonic rising movement and in the plateau before a falling movement

A *zanos* is a separate pretonic movement; it does not have the property of changing a falling pitch accent into another type. The falling accent with a *zanos* is usually, but not necessarily, a final fall. A *zanos* occurs within one word, on a preposition or elsewhere over a word boundary. The occurrence of a *zanos* over a word boundary probably implies that the two words belong to

the same prosodic group. A *zanos* is perceptually interpreted as the above-mentioned small and steep rise, even in cases in which pitch is acoustically level in the *zanos*.

5.6 Posttonic parts

In the present section the last of the perceptually relevant features of pitch accents will be discussed. The set of features needed for a perceptual description of Russian intonation will then be complete: the excursion (register), timing and posttonic part.
The posttonic part in a configuration of pitch movements is an (independent) distinctive feature in Russian intonation. Some types of pitch accent are distinguished from one another on the basis of only the posttonic part. If in such cases the posttonic part were cut off, the type of pitch accent would not be recognizable.
Tonic parts are described in terms of rising and falling movements. Posttonic parts are described in terms of the level, that is: the end frequency between the high and low reference level that is reached in the posttonic part.
The description of posttonic parts is based on the results of the perception experiments discussed in chapter 4.
In section 5.6.1 the posttonic levels that have been found to exist will be described. In sections 5.6.2 and 5.6.3 the posttonic movements, the limits of perceptual tolerance within the posttonic parts and compensation strategies will be discussed with examples.

5.6.1 Reference levels for posttonic parts

After rising pitch accents the following posttonic levels are distinguished:
- high level;
- midfield;
- low level.

After falling pitch accents the levels that have to be distinguished are:
- high level or midfield;
- non-low level;
- low level.

Pitch accents also occur without posttonic parts. A full picture, with posttonic levels indicated in the range between high and low after rising and falling pitch accents, is given in figures 5.12 and 5.13.

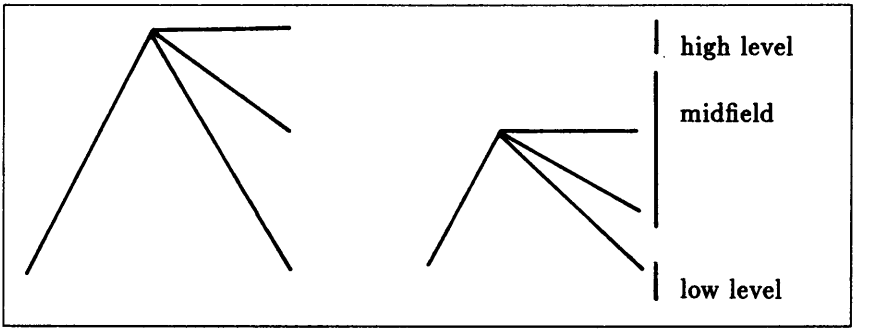

Figure 5.12: High, middle and low level after rising pitch accents

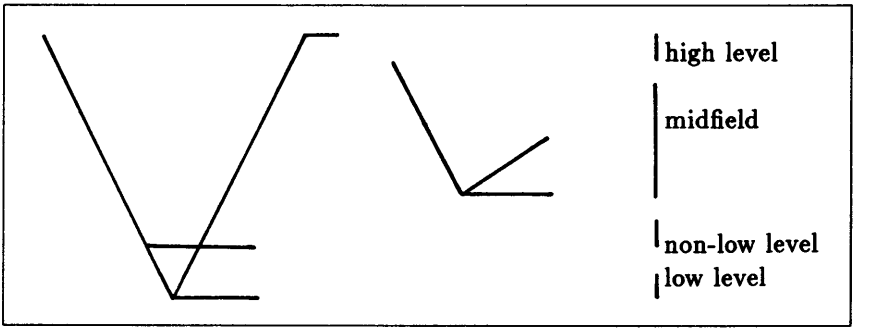

Figure 5.13: High, middle, non-low and low level after falling pitch accents

Schematically the posttonic levels after rising and falling pitch accents are presented in figure 5.14.
Finally, movements in the syllables after perceptually relevant posttonic parts do not belong to a given type of pitch accent, except for type Fh- (see table 4.11). Pitch movements which connect pitch accents will be discussed in section 5.6.4.

5.6.2 Posttonic parts after rising pitch accents

A *high level* posttonic part occurs after rises with a large excursion. After the accented syllable, pitch continues (with some declination) essentially at the same level as the highest point in the accented syllable. In a type Rh-realization the declining posttonic movement or level does not reach a point below a non-high level (see below). An example is given in fig. 5.15.
The high level and the midfield are separated from each other by the *non-high level.* The non-high level indicates the borderline in the posttonic part

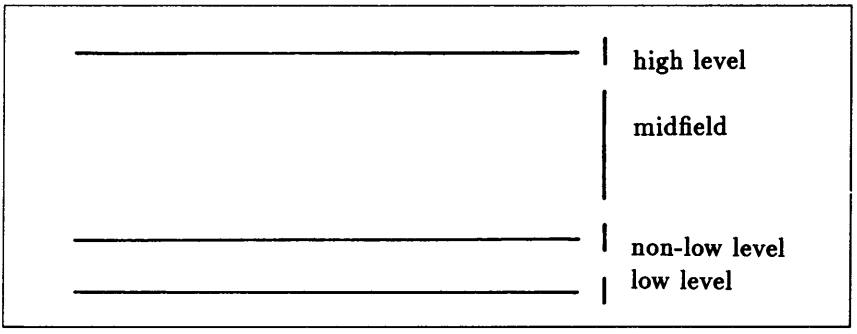

Figure 5.14: Posttonic levels

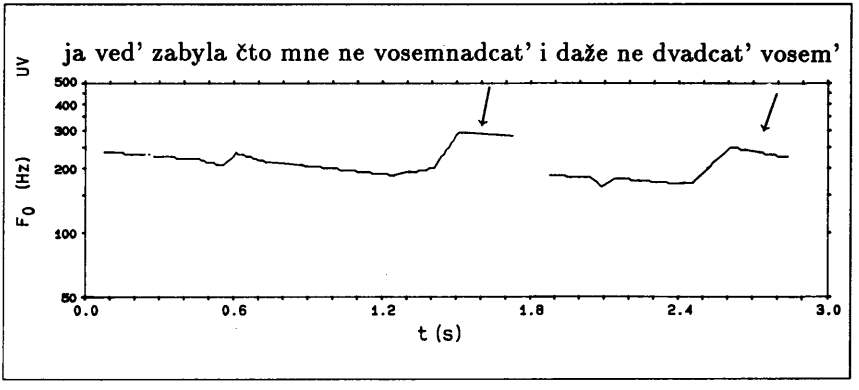

Figure 5.15: The posttonic high level of type Rh-

between two discretely different types of pitch accent: Rh- and Rm-/Rm+. The posttonic non-high level for types Rh- and Rm-/Rm+ is presented in an example in figure 5.16.

A posttonic movement in a realization Rm- always reaches a point which is situated below the non-high level, and in a realization Rm+ on or below the non-high level. Type Rh- always reaches a point situated above the non-high level.

The *middle* posttonic part or *midfield* is not a level. It is a range between high and low which is defined by the non-high level and the non-low level. Questions about the posttonic *middle* part were the issue in e.g. the triadic experiment (section 4.4). Posttonic movements in realizations of type rm-/rm+ always end in the midfield.

In figure 5.17 some examples are given of posttonic movements which end in the midfield.

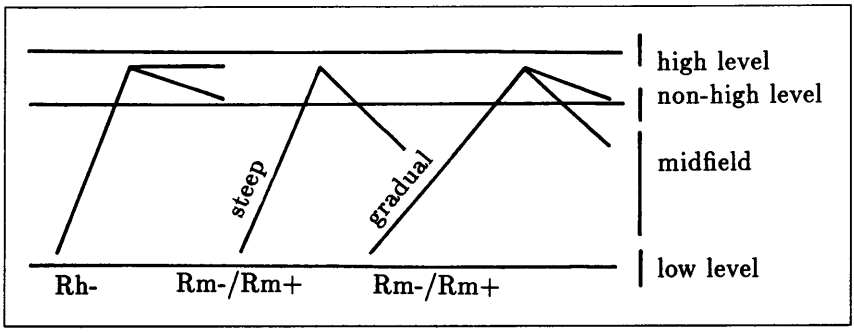

Figure 5.16: Types Rh- and Rm-/Rm+ and the posttonic non-high level

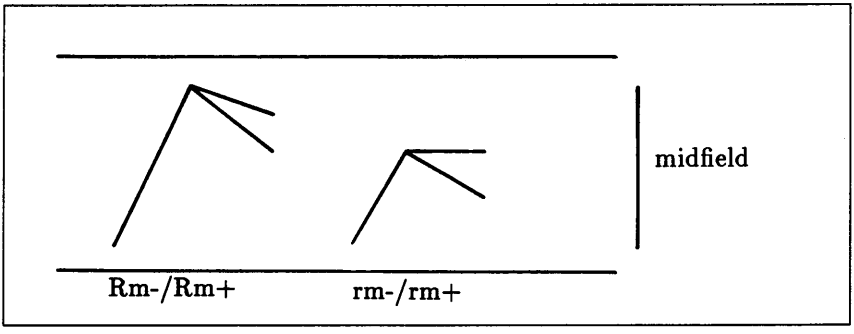

Figure 5.17: The posttonic midfield of types Rm-/Rm+ and rm-/rm+

The posttonic *low level* occurs in the configuration Rl- and rl-/rl+. The posttonic movement reaches a point on or below the non-low level. Compared with other posttonic movements, the slope is steep. The examples in figure 5.18 show the differences for the two types.

Types of rising pitch movements *without* a posttonic part occur both high and low in the register. Types Rh- and Rl- are neutralized in type Rø-. Even without a posttonic part type Rm-/Rm+ is audibly different from type Rø-. In the former type a beginning fall was sometimes already perceivable in the accented syllable itself. Types of rising pitch accent also occur without posttonic part low in the register. However, it makes no sense to speak about neutralization between high and middle low in the register, since posttonic high does not exist low in the register. There were not enough examples of type rl-/rl+ to enable anything to be said about neutralization for this type. Examples of rising pitch accents without a posttonic part high and low in the register are presented in figure 5.19.

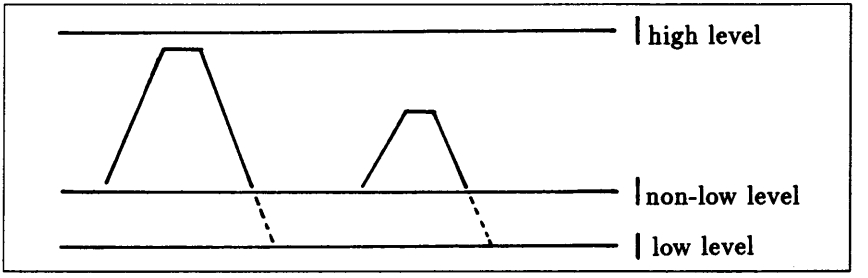

Figure 5.18: The posttonic non-low and low level of type Rl- and type rl-/rl+

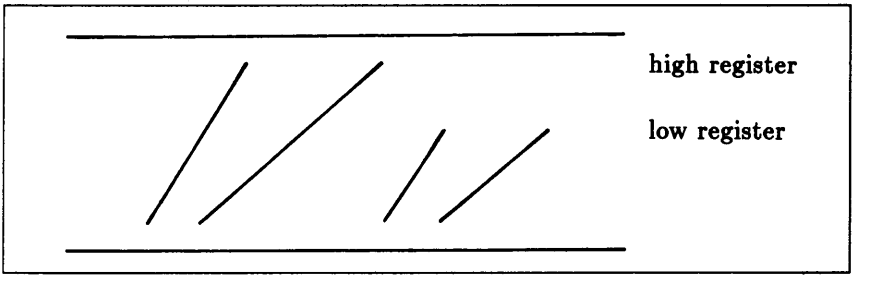

Figure 5.19: Posttonic ø high and low in the register

The posttonic movements after rising pitch movements may vary within certain limits of perceptual tolerance. These limits and some compensation strategies will be demonstrated in the following examples.

If the timing is early and the slope steep in a type Rm- realization, the posttonic part will fall to a lower point than the non-high level and the slope of the posttonic movement will be steeper than just declination, probably in order to avoid confusion with Rh-.

If the timing is late, the slope steep or gradual, and the posttonic part level (type Rm+), no confusion will occur with Rh-, because the latter always has early timing.

Realizations of types Rm+ and rm+ may reach a point below the non-low level. Realizations of types Rm- and rm- may not end below the non-low level: if the posttonic movement reached the low level, these configurations would be realizations of types Rl- and rl-.

Sometimes a type Rl- or rl-/rl+ realization is soon followed by another pitch accent and there is no "time enough" for the posttonic movement to come down completely. In such cases a compensation in other features can be observed, e.g. the posttonic movement may have a steeper slope than usual.

The different posttonic levels will now be presented in another way. The pictures below indicate to what extent the posttonic movements may vary and for what types they may not.
Imagining the tonic and posttonic movements as two sticks hanging on a drawing pin, the angle between the two sticks is fixed for Rh-, Rl- and rl-. For Rm-/Rm+, rm-/rm+ and rl+ it is not fixed. In figure 5.20 the angle is fixed.

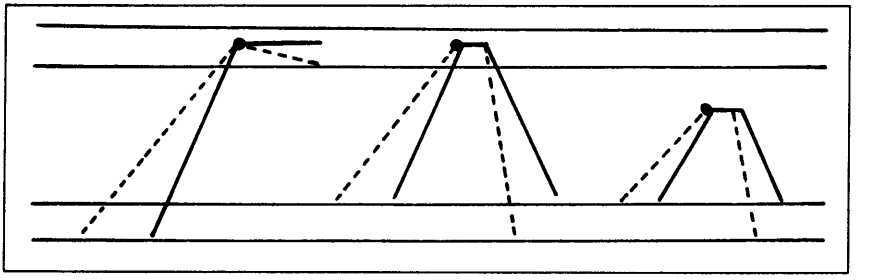

Figure 5.20: Limits of perceptual tolerance for types Rh-, Rl- and rl-

The first picture shows type Rh-. If the left-hand stick is pushed to the left, the slope becomes gradual and the "posttonic" stick reaches a lower point. If the posttonic stick had reached a point below the non-high level the type would have been changed into an Rm- realization, as shown in figure 5.21.
The first picture in figure 5.20 indicates the limits of perceptual tolerance for Rh-.
In the second picture a realization of type Rl- is presented with a posttonic movement that reaches the non-low level. The angle is fixed. If the left stick is pushed to the left the slope in the tonic movement becomes more gradual, but the posttonic movement is steeper and reaches a lower point. This is the compensation for the gradual slope. Note that timing in the pictures is not affected: the drawing pin hangs on the same spot.
For a realization of type rl- in the third picture the same modification has been made as for the realizations of type Rl- in the second picture.
In figure 5.21 the angle is not fixed. The sticks can move to and fro.
A type Rm- realization can have the same rise (early) as a type Rh- realization. The difference is then heard in the part after the rise. The dotted lines in the picture indicate how far the sticks can swing independently without causing confusion with the realizations of types presented in figure 5.20. The limits of perceptual tolerance are so large that the drawing pin can move, which affects the timing of the movement. The posttonic movements in the picture reach different points in the midfield and show in what cases they can even reach a

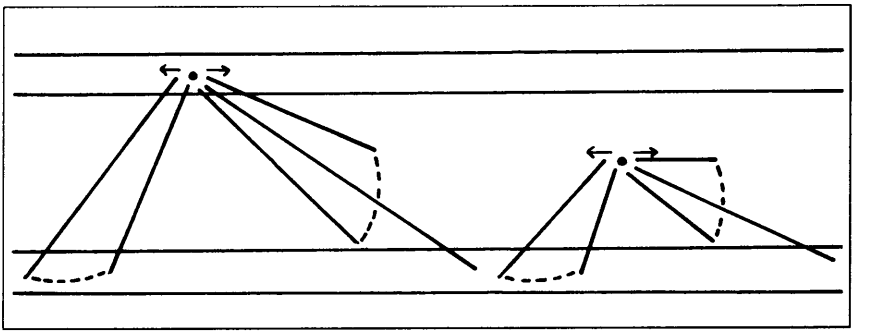

Figure 5.21: Limits of perceptual tolerance for types Rm-/Rm+ and rm-/rm+

point below the non-low level. The picture indicates the limits of perceptual tolerance for the posttonic movements of realizations of types Rm-/Rm+ and rm-/rm+.
One possible realization of Rm+ is not indicated in picture 5.21: Rm+ with level posttonic part (see figure 5.5). In this case the slope must be gradual.

5.6.3 Posttonic parts after falling pitch accents

After the accented syllables of types Fl- and Fl+, pitch continues in the posttonic movement on the *low level.* After the accented syllables of types Fnl- and Fnl+, pitch continues on the *non-low level.*
Examples are given in figure 5.22.

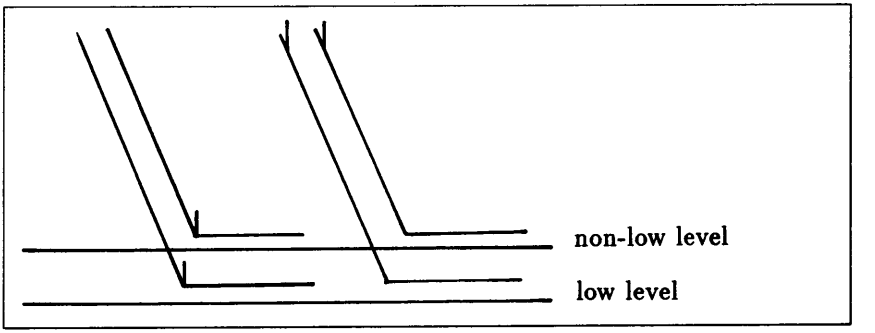

Figure 5.22: Posttonic low and non-low level after types Fl-, Fnl-, Fl+, and Fnl+

There is a perceptual difference between falling pitch accents which do and do not reach the low level. This difference has already been indicated in the names of the types.

If the non-low level is reached in the accented syllable, but pitch falls in the posttonic part to the low level, it is perceived and classified as a type Fl realization. If pitch in the posttonic part continues on the non-low level and does not reach a point below this level it is a falling accent of type Fnl.
Falling pitch accents of type f-/+ are situated above the non-low level in the tonic and in the posttonic part. The posttonic movement after a type f-/+ realization usually rises to the next pitch accent, for instance, in the sawtooth pattern. But if the posttonic movement continues to fall after a type f-/+ realization it does not reach a point below the non-low level. The posttonic part reaches a point that lies in the midfield. Posttonic parts after falling movements do not use the whole range of the midfield in the same way as posttonic parts after rising pitch movements. Rising posttonic movements after falling pitch accents of type f-/+ do not have a steep slope.
Falling pitch accents of type Fh- have a rising posttonic movement (usually with a steep slope), which is the distinctive feature of this type as compared with Fl-. The posttonic movement reaches a high point in the midfield and pitch continues on that level in the next syllable(s), or the posttonic part reaches that high point in a gradually rising movement.
As compared with the high level in the posttonic parts after rising pitch accents, the high level after falling pitch accents is situated on a lower level in the range between high and low. But since it has only to be distinguished from rising posttonic movements after realizations of type f-/+ it has been called *high level.*
The posttonic part after falling pitch accents of type F^n+ reaches a high level, but pitch does not continue on the high level in the following syllables as it does after type Fh-. After the posttonic high level a *zanos* occurs and the next type F^n+ realization will follow. The last realization in a sequence of type F^n+ always shows a rise in the posttonic part, but that rise does not reach a point as high as after a type Fh- realization.
If the posttonic part after realizations of type F^n+ and type Fh- is cut off the two types are not neutralized.
Without a posttonic rising movement, type F^n+ probably belongs to a type Fl+ or Fnl+; type Fh- without posttonic part would now belong to a type Fl- or Fnl- (see section 4.6).

5.6.4 Turning points

Pitch accents are connected by non-prominence lending pitch movements. Non-prominence lending movements continue to a following pitch accent or to a turning point in between two pitch accents.
At a given point between pitch accents which are not separated by a reset, a pause or a silence, the non-prominence lending pitch movement after the last accent turns into a non-prominence lending pitch movement to the next accent. The position of the turning point or boundary between two accents determines the slope of the preceding and following connecting movements.
In figure 5.23 two turning points are presented.
In the first example the turning point is situated closer to the second pitch accent than to the first pitch accent. As a consequence, the slope of the connecting movement is more gradual, and the slope of the second pitch accent is steeper.
In the second example the turning point is situated farther away from the second pitch accent. The slope in the connecting movement after the first pitch accent is steeper, the slope of the second pitch accent is more gradual.

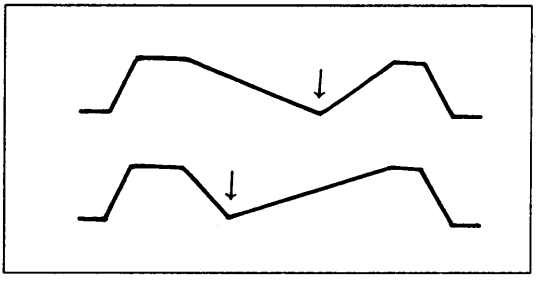

Figure 5.23: Turning points between two pitch accents

Perceptually it is not acceptable to disregard differences in the position of the turning points. It is probably linguistically relevant to know which connecting non-prominence lending movements belong to which pitch accent. In other words: how are words grouped together prosodically and semantically? This linguistic issue has not been tackled in the present research, but the position of the turning points can be seen in the corpus.

5.7 Types of boundaries

A boundary separates streams of thoughts and indicates which pitch movements, including the non-prominence lending movements, belong to the preceding pitch accent and which to the next pitch accent.
A *prosodic* boundary, which is usually not only defined by pitch but also by the temporal organization (De Rooij 1979) and which is important for the semantic organization of an utterance (Keijsper 1984), does not necessarily coincide with a *syntactic* boundary.

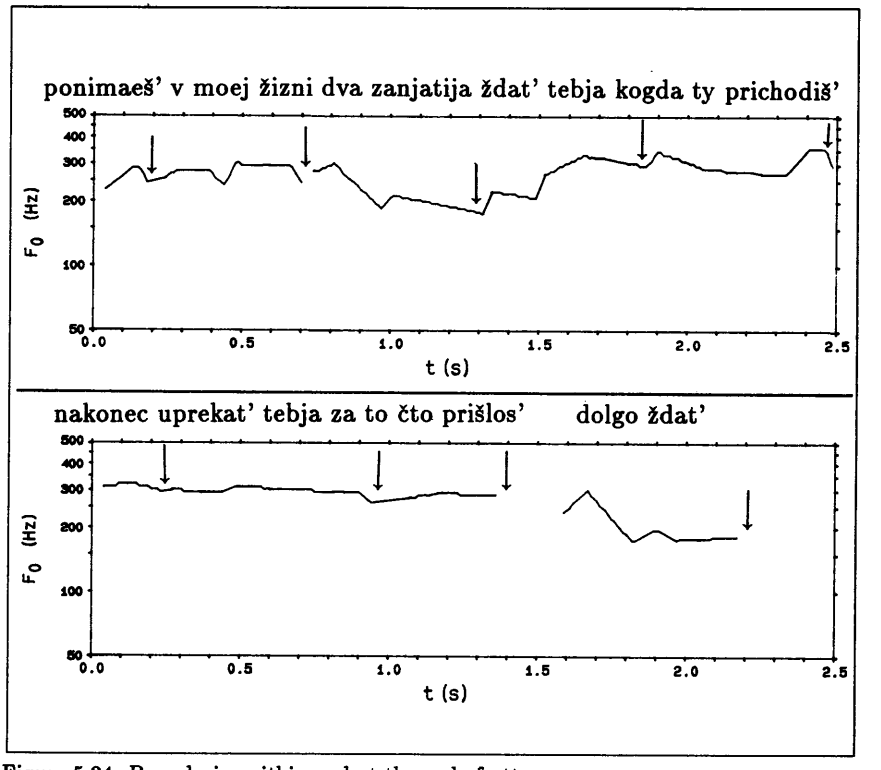

Figure 5.24: Boundaries within and at the end of utterances

Types of boundaries are: a *silence*, a *hesitation* or a *pause* within or at the end of an utterance, a *reset*, and a *turning point* between two pitch accents. The end and the beginning of a stream of thoughts can be marked intonationally. In spontaneous speech a stream of thoughts can suddenly be broken off. The speaker has not found a way to compensate for and correct the in-

terrupted intonation contour; the unexpected end of the stream of thoughts has not been anticipated intonationally. Sometimes a declination reset occurs at such interruptions.
Examples of boundaries within and at the end of an utterance are presented in figure 5.24.
A *silence* is the absence of vocalization; it can occur at a boundary and within an utterance. In the stylized pitch contours the line is interrupted at a silence (see chapter 7). In figure 5.25 the gain and waveform are also plotted in order to show the silence.

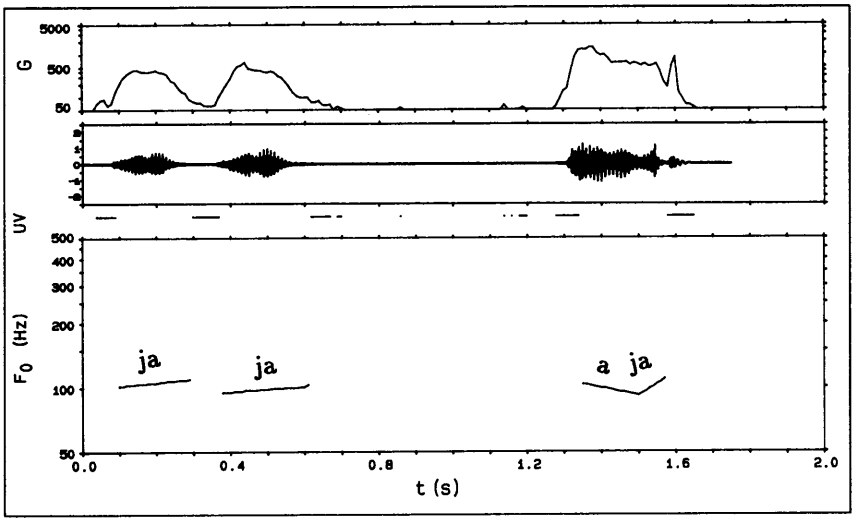

Figure 5.25: A silence within an utterance

A silence is easy to determine: the waveform is interrupted.
Pauses and *hesitations* are found frequently in the spontaneous texts. Pauses and hesitations can be filled with humming and hawing (indicated with "gm" in the texts) or vowel-lengthening (not indicated in the texts). Unfilled silent pauses and silent hesitations occur within an utterance of one speaker and may be preceded or followed by humming and hawing; they are indicated with an interruption in the stylized pitch contour in chapter 10 and an ellipsis (...) in the text in chapter 9. Some examples of filled and unfilled pauses and hesitations are given in figure 5.26.

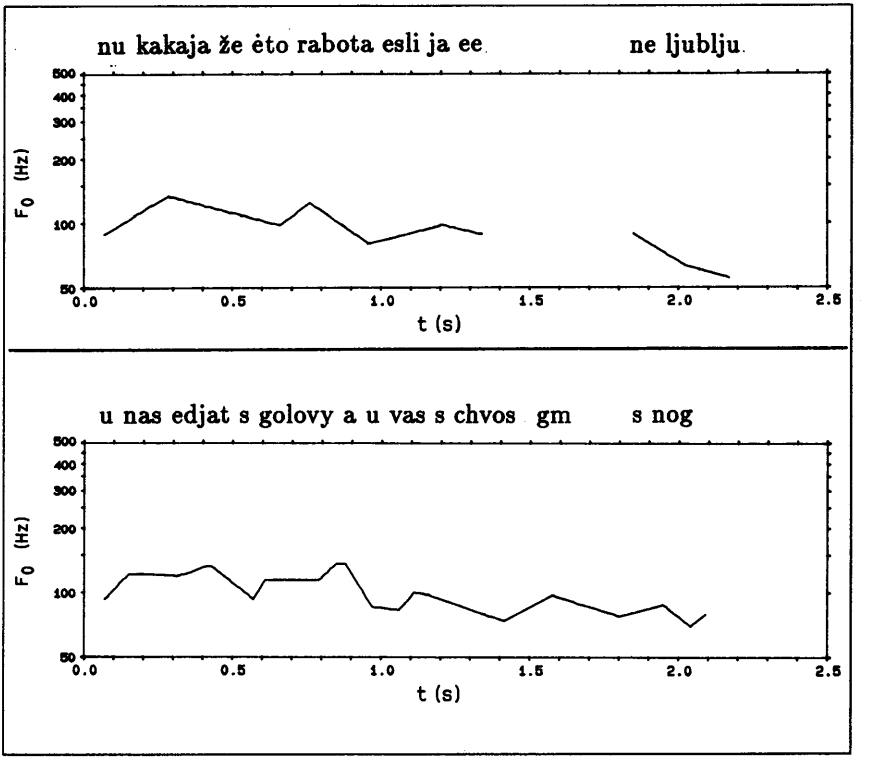

Figure 5.26: Filled and unfilled pauses and hesitations within an utterance

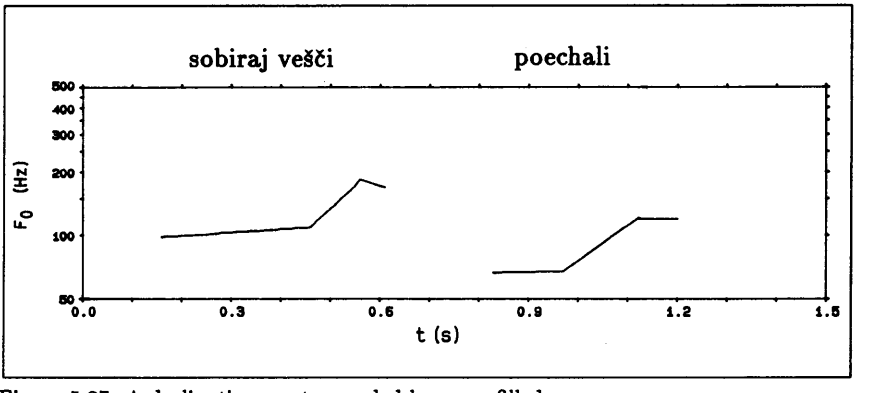

Figure 5.27: A declination reset preceded by an unfilled pause

A *declination reset* is sometimes preceded by an unfilled pause (absence of vocalization). A reset cannot be interpreted as a connecting pitch movement in the contour and stylized pitch contours are therefore interrupted at a reset (see chapter 7). An example is presented in figure 5.27.
An example of a *turning point* as a type of boundary is presented in section 5.6.4.

Chapter 6

An overview of averaged phonetic data

In this chapter an overview of averaged phonetic data from the corpus is presented in tables with types of rising and falling pitch accent, which result from classifications of texts by individual speakers (chapter 8), experiments (chapter 4) and perceptually relevant features of Russian pitch movements (chapter 5). First, the average values for all types of pitch accent for each speaker will be given with maximum and minimum values between brackets. Next, the average values for all speakers will be presented, i.e. the average of averages. Note that the averages abstract away the differences between various realizations. The types of pitch accent will be illustrated with pictures. An explanation of the abbreviations used in the tables can be found in sections 4.5.5 and 4.6. The names of features of pitch accents have been discussed in chapter 5.

6.1 Rising pitch accents

On the basis of the outcome of average values given in the tables, the average register and reference levels for rising pitch accents can be defined as follows:
high register: 11-21 ST;
low register: 0-11 ST;
high reference level: 21 ST;
low reference level: 0 ST;
midfield: above 4 ST (see also section 8.1).
The excursion is always measured from the low reference level, irrespective of the actual excursion (see section 5.2). The slope is always measured from the begin to the end frequency in the actual perceptually relevant rising pitch movement. As a rule, types of rising pitch accent indicated with the sign - have

early timing. Realizations of these types with late timing will be commented upon in chapter 8. Data as to early and late timing are not given in the tables, but the percentage of deviating cases has been indicated (see also section 5.3). In the last table, table 6.8, all features are summarized for all speakers in the corpus.

register		
speaker	low register in ST	high register in ST
Pokrovskij	0-11	11-23
Kukol'ščikova	0-12	12-27
Denisov	0-10	10-17
Cvetkova	0-10	10-17
Panasjuk	0-12	12-24
Asinovskij	0-12	12-20
Reporter	0-12	12-20
Gorbačev	0-13.5	13.5-20
Okudžava	0-10	10-20
all speakers	0-11	11-21

Table 6.1: Register

type Rl-				
speaker	plateau in ms	excursion in ST	slope in ST/s	timing
Pokrovskij	70 (60-80)	21 (18-23)	100 (48-169)	
Kukol'ščikova	52 (20-80)	21 (17-24)	76 (57-92)	
Denisov	60 (50-70)	15 (13-16)	66 (63-39)	
Cvetkova	84 (50-140)	13 (10-16)	57 (181-131)	
Panasjuk	57 (30-80)	19 (16-24)	91 (45-190)	
Asinovskij	60	15 (10-20)	61 (35-88)	
Reporter	72 (40-110)	17 (15-19)	64 (24-129)	
Gorbačev	40	17	54	
Okudžava	40	17 (16-18)	116 (45-191)	
all speakers	60 (40-84)	17 (13-21)	76 (54-116)	early 89% late 11%

Table 6.2: Type Rl-

type Rh-			
speaker	excursion in ST	slope in ST/s	timing
Pokrovskij	20 (17-21)	72 (45-115)	
Kukol'ščikova	18 (16-20)	55 (16-64)	
Denisov	16 (13-17)	35 (21-52)	
Cvetkova	15 (13-17)	69 (57-81)	
Panasjuk	20 (16-23)	120 (82-151)	
Asinovskij			
Reporter	17 (13-20)	59 (43-119)	
Gorbačev	15 (13-18)	110 (66-166)	
Okudžava			
all speakers	17 (15-20)	74 (35-120)	early 95% late 5%

Table 6.3: Type Rh-

type Rø-			
speaker	excursion in ST	slope in ST/s	timing
Pokrovskij	20 (19-21)	86 (57-106)	
Kukol'ščikova	21 (18-27)	72 (49-102)	
Denisov	13 (11-15)	44 (20-64)	
Cvetkova	13 (11-15)	30 (28-32)	
Panasjuk	18 (13-23)	80 (23-145)	
Asinovskij	11	51	
Reporter	17 (13-20)	68 (25-119)	
Gorbačev	15	144	
Okudžava	14 (12-18)	82 (67-98)	
all speakers	16 (13-21)	73 (30-86)	early 84% late 16%

Table 6.4: Type Rø-

type Rm-/+			
speaker	excursion in ST	slope in ST/s	timing
Pokrovskij	17 (12-23)	57 (14-129)	
Kukol'ščikova	16 (12-23)	52 (23-147)	
Denisov	13 (12-17)	48 (14-77	
Cvetkova	11 (10-14)	39 (20-92)	
Panasjuk	16 (12-22)	54 (17-140)	
Asinovskij	15	94	
Reporter	16 (12-20)	50 (15-126)	
Gorbačev	15 (11-20)	62 (22-175)	
Okudžava	14 (10-20)	73 (14-130)	
all speakers	15 (11-17)	54 (39-94)	early 70% late 30%

Table 6.5: Type Rm-/+

type rm-/+			
speaker	excursion in ST	slope in ST/s	timing
Pokrovskij	8.5 (5-11)	45 (7-107)	
Kukol'ščikova	10.5 (8-12)	19 (13-30)	
Denisov	9.5 (6-12)	30 (4-84)	
Cvetkova	9 (6-10)	25 (11-38)	
Panasjuk	10.5 (8-12)	39 (10-194)	
Asinovskij	9.5 (8-12)	28 (21-39)	
Reporter	9.5 (5-12)	35 (6-107)	
Gorbačev	12 (11-13)	56 (6-84)	
Okudžava	7.5 (3-10)	35 (17-69)	
all speakers	10 (8.5-12)	35 (19-56)	early 60% late 40%

Table 6.6: Type rm-/+

type rl-/+				
speaker	plateau in ms	excursion in ST	slope in ST/s	timing
Pokrovskij				
Kukol'ščikova				
Denisov	65	12	48	
Cvetkova	95	9	41	
Panasjuk	100	12	23	
Asinovskij				
Reporter	80	12	95	
Gorbačev				
Okudžava				
all speakers	85	11	52	early 87.5% late 12.5%

Table 6.7: Type rl-/+ (without minimum and maximum values: there are only 8 realizations of this type)

type	excursion	timing	posttonics	slope in ST/s	register
Rl-	17 ST	89% early 11% late	low	76	high
Rh-	17 ST	95% early 5% late	high	74	high
Rø-	16 ST	84% early 16% late	ø	73	high
Rm-/+	15 ST	70% early 30% late	middle	54	high
rm-/+	10 ST	60% early 40% late	middle	35	low
rl-/+	11 ST	87.5% early 12.5% late	low	52	low

Table 6.8: Types of rising pitch accent: average values

In figure 6.1 the types of rising pitch accents are presented on a logarithmic scale. The time scale is not indicated. The duration of the plateau for types Rl- and type rl- has been given, however.

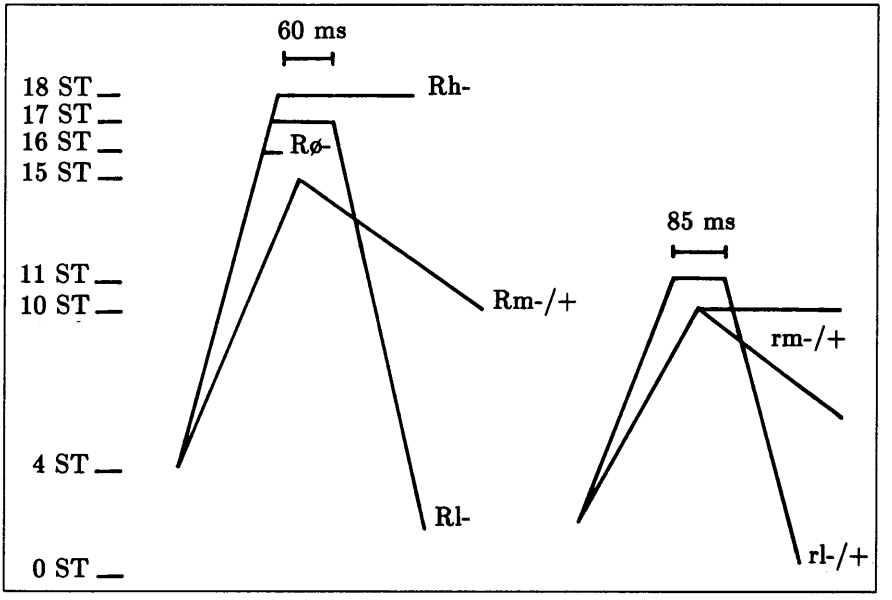

Figure 6.1: Types of rising pitch accent

6.2 Falling pitch accents

In the tables with falling pitch accents the phonetic features indicate the following.
Excursion: this is always the *actual* excursion, measured from the begin to the end frequency of the perceptually relevant falling pitch movement. The slope of the perceptually relevant pitch movement is indicated in semitones per second. Non-low or above low: the value in this column indicates the level in semitones above the low level (= 0 ST).
For type Fh- the excursion of the rising posttonic part and the duration of the high posttonic level are also indicated. In table 6.16 the falling movement of type Fh- has been averaged on the basis of realizations where falling movements did occur: some realizations show a low level before the rising posttonic movement. The latter is given in the column *plateau* in table 6.13.

type Fl-		
speaker	excursion in ST	slope in ST/s
Pokrovskij	9 (5-12)	71 (41-81)
Kukol'ščikova		
Denisov	7	30
Cvetkova	6 (5-7)	45 (43-47)
Panasjuk	8 (3-21)	56 (16-152)
Asinovskij	6 (2-10)	47 (18-75)
Reporter	7 (3-10)	39 (6-76)
Gorbačev		
Okudžava	11 (4-17)	39 (22-55)
all speakers	8 (6-11)	47 (39-71)

Table 6.9: Type Fl-

type Fnl-			
speaker	excursion in ST	slope in ST/s	ST above low
Pokrovskij	8 (8-9)	62 (45-79)	3
Kukol'ščikova	3 (3-4)	23 (15-30)	4 (3-5)
Denisov			
Cvetkova	4 (3-4)	35 (18-51)	5 (4-6)
Panasjuk	8 (2-15)	42 (9-77)	3 (2-5)
Asinovskij	6 (2-10)	47 (18-76)	3 (2-4)
Reporter	4 (2-11)	35 (12-50)	5 (3-7)
Gorbačev			
Okudžava	16	55	3
all speakers	7 (3-16)	42 (15-62)	4 (3-5)

Table 6.10: Type Fnl-

type Fl+		
speaker	excursion in ST	slope in ST/s
Pokrovskij	12 (8-16)	60 (29-94)
Kukol'ščikova	11 (9-12)	57 (40-75)
Denisov	10	34
Cvetkova	11	32
Panasjuk	7 (2-12)	45 (13-73)
Asinovskij	7 (5-10)	52
Reporter	7 (3-11)	49 (16-82)
Gorbačev	13 (3-20)	54 (24-76)
Okudžava	6 (2-10)	43 (19-57)
all speakers	9 (6-13)	47 (32-60)

Table 6.11: Type Fl+

type Fnl+			
speaker	excursion in ST	slope in ST/s	ST above low
Pokrovskij	11 (3-17)	61 (13-97)	4 (2-7)
Kukol'ščikova	11 (2-22)	83 (16-158	5 (2-10)
Denisov	5 (1-9)	31 (8-64)	4 (2-9)
Cvetkova	5 (1-8)	26 (4-45)	3 (2-4)
Panasjuk	7 (2-16)	47 (12-105)	5 (2-7)
Asinovskij	11 (3-12)	66 (15-148)	4 (2-6)
Reporter	6 (3-9)	42 (12-68)	5 (2-8)
Gorbačev			
Okudžava	7 (1-10)	45 (6-91)	2 (2-5)
all speakers	8 (5-11)	50 (26-83)	4 (2-5)

Table 6.12: Type Fnl+

type Fh-						
speaker	actual excursion in ST	slope in ST/s	plateau in ms	actual post-tonic rise in ST	high level in ms	level above low in ST
Pokrovskij	6 or level	58 (22-90)	117	9	113	11
Kukol'ščikova	7 or level	37 (29-46)	120	5	140	12
Denisov	5 or level	10 (9-12)	70	8	400	11
Cvetkova						
Panasjuk	5 or level	36	85	8.5	50	15
Asinovskij						
Reporter	level		200	7	90	16
Gorbačev						
Okudžava						
all speakers	6 (5-7)	35 (10-58)	118 (50-200)	9 (4-12)	158 (50-450)	13 (7.5-17)

Table 6.13: Type Fh-

type F^n+		
speaker	excursion in ST	slope in ST/s
Pokrovskij	10 (8-13)	65 (55-73)
Kukol'ščikova		
Denisov		
Cvetkova		
Panasjuk		
Asinovskij		
Reporter		
Gorbačev		
Okudžava		

Table 6.14: Type F^n+

type f-/+			
speaker	excursion in ST	slope in ST/s	ST above low
Pokrovskij	6 (4-10)	57 (15-200)	6 (3-12)
Kukol'ščikova	4 (1-7)	24 (2-45)	8 (4-17)
Denisov	2 (1-4)	14 (5-36)	6 (3-11)
Cvetkova	2.5 (1-4)	19 (7-27)	6 (4-8)
Panasjuk	3 (1-8)	26 (6-73)	8 (4-17)
Asinovskij	2 (1-4)	22 (8-39)	6 (5-6)
Reporter	3 (1-6)	23 (4-64)	7 (3-16)
Gorbačev	6	31	2
Okudžava	5 (2-9)	36 (13-77)	5 (2-7)
all speakers	4 (2-6)	28 (14-57)	6 (5-8)

Table 6.15: Type f-/+

type	excursion	slope	above low	posttonics
Fl-	8 ST	47 ST/s	0 ST	low
Fnl-	7 ST	42 ST/s	4 ST	non-low
Fl+	9 ST	47 ST/s	0 ST	low
Fnl+	8 ST	50 ST/s	4 ST	non-low
Fh-	6 ST	35 ST/s	4 ST	rises 9 ST to 13 ST above low
F^n+	10 ST	65 ST/s		rising
f-/+	4 ST	28 ST/s	6 ST	varying

Table 6.16: Types of falling pitch accent: average values

On the basis of the average values given in the tables the reference level for falling pitch accents can be defined as follows:
low reference level: 0 ST;
non-low reference level: 4 ST above low;
above non-low for type f-/+: 6 ST above low;
high level for type Fh-: 13 ST above low.
In figure 6.2 the types of falling pitch accents are presented on a logarithmic scale. The time scale has not been indicated (see also section 6.1); the duration of the plateau for type Fh- has been given, however.

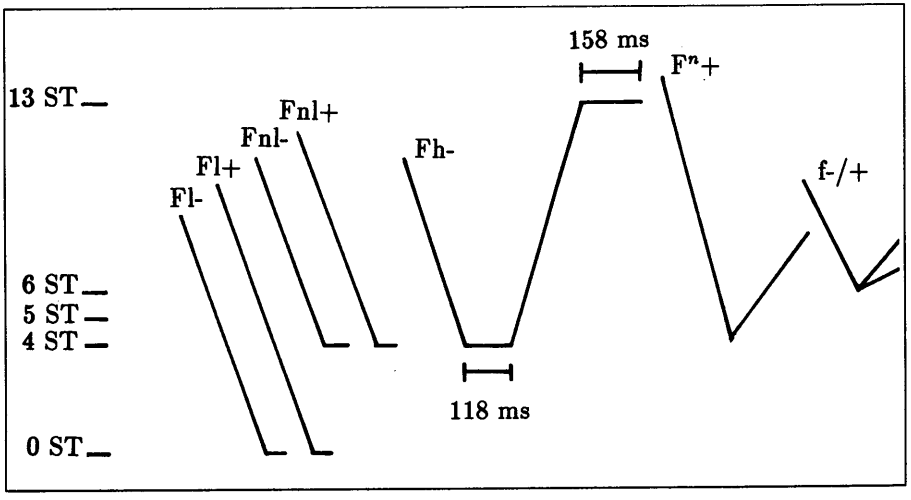

Figure 6.2: Types of falling pitch accent

Part II: Corpus

Chapter 7

From close-copy stylizations to traced copies: notational conventions

The corpus of the eight excerpts is represented in Volume 2 in stylized pitch contours on a logarithmic scale. The contours are a direct copy of the computer output. The logarithmic scale values in hertz are given on the left side before every contour: from bottom to top the horizontal dashes on the vertical line, beginning with the first dash, indicate the level of 50, 100, 150, 200, 250, 300, 350, 400, 450 and 500 hertz, respectively. The time scale is not drawn horizontally since the whole corpus has been put on the same time scale: 1 second is always 2.96 cm. A full line is about 4 seconds. There are three lines with contours on one page, i.e. about 12 seconds of speech.

The stylized pitch contours were first plotted on a plotter directly from the computer. In the plots there were interruptions in the contours caused by unvoiced parts. The voiced parts were connected with one another: in speech perception listeners do exactly the same. In this way, the stylized pitch contours show the movements that were intended by the speaker rather than those which an acoustic representation with interruptions caused by accidental unvoiced parts would show. Thus, a pitch contour with unvoiced parts is represented in the same way as a perceptually identical pitch contour with only voiced parts.

First it was established whether the interruption in the contour was indeed an unvoiced part and not, for instance, a silence (see also section 5.7). The unvoiced parts were "filled in" manually by connecting the last point of the previous voiced part with the first point of the next voiced part. Very short unvoiced parts were connected by extending the straight-line segments of the previous and next voiced parts in the same direction until they intersected, except if the intersection would then occur at a point incorrectly suggesting a large movement.

An interruption in the contour has not been filled up where a silence, pause or reset occurs. Such interruptions occur within an utterance of one speaker or at a point where another speaker takes over. The end of a line normally coincides with a pause, but sometimes a contour must be read as continuing on the next line without any boundary whatsoever. The latter cases are marked with the sign $\longrightarrow$.
The variable real duration of a silence at a boundary or pause is not given at the end of a line. The duration of an interruption within one line corresponds to the original real duration.
After the interruptions in the contours on the plots had been filled up (or left unconnected), I indicated in the contours where the accented syllables and the vowel onsets were situated. The plots were now ready to be copied.
The stylized pitch contours were drawn in thin and in bold lines. A bold part in the contour marks the accented syllable. In the text under the contour, given in transliteration, the accented syllable is underlined. If an additional pitch accent occurs in a word with pitch accent (see, for instance, section 8.8), the syllable with word stress is indicated with a stress mark.
A perpendicular little dash on the bold line points to the vowel onset in the accented syllable: the vowel onset is at the point where the dash touches the bold line. In the texts in chapter 9 a silence is marked by an ellipsis (...). Humming and hawing is marked in the text with "gm" (often preceded or followed by an unfilled pause); vowel lengthening is not marked. Silences correspond to interruptions in the stylized contours.
In many cases the written text is "longer" than the contours. I have tried to print a word with pitch accent directly under the bold line to which it corresponds, which meant I often needed two text lines. If the text is interrupted on the upper line, it continues on the lower line and then continues again on the upper line.
An example of an original plot of a stylized pitch contour with unvoiced parts or other interruptions and the traced copy of the same contour as it is finally printed in chapter 10 is given below in figures 7.1 and 7.2.
The text in English translation is printed at the bottom of every page in three lines that correspond to the text lines under the contours. Punctuation marks have been omitted. In the translation the end of a line is marked with the sign / .
The integral Russian text in Cyrillic and the English translation, both in a "normal" reading version with punctuation marks etc., can be found in chapter 9. In these texts parts that were left out of the analysis because

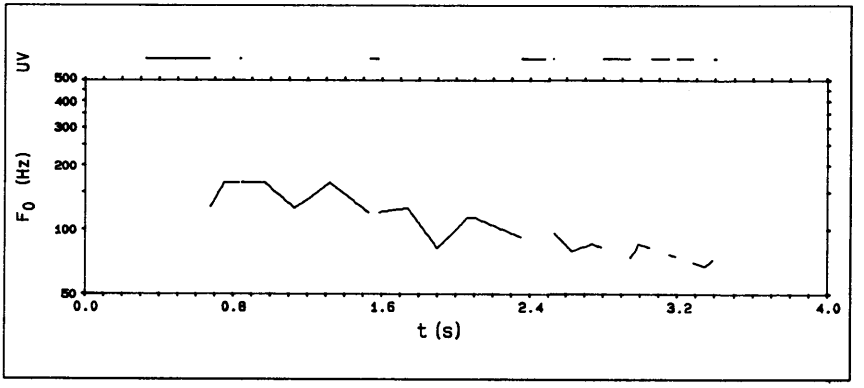

Figure 7.1: Output of a close-copy stylization from the plotter

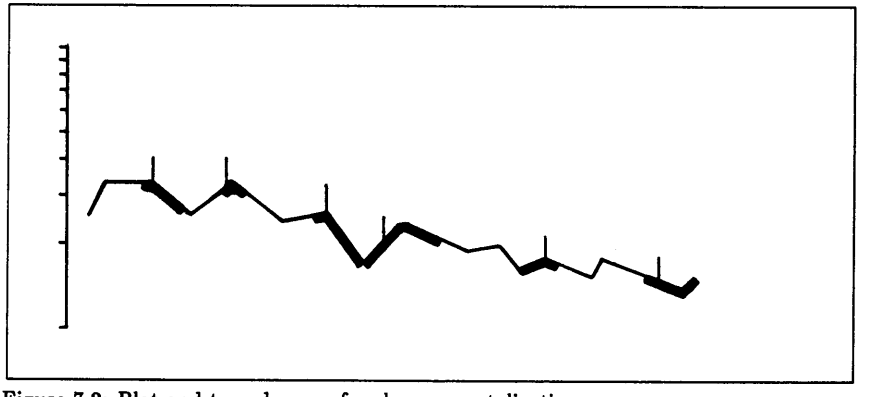

Figure 7.2: Plot and traced copy of a close-copy stylization

speakers talked simultaneously or laughed, have been maintained (see also section 2.3.1).

The type and number of the pitch accents are printed below the text under the stylized pitch contours. The accents are numbered for each excerpt. The numbers correspond to those used in chapter 8. Pitch accents preceded by a *zanos* are marked with an asterisk.

The integral texts correspond to the original recording on the cassette; the texts under the stylized pitch contours correspond to the close-copy stylizations on the cassette (except in the film excerpt, see section 8.10).

Chapter 8

Comments on the corpus

8.1 Introduction

In this chapter the speech excerpts in the corpus will be commented upon. After a short discussion of the selection of the excerpts and the type of speech the following issues will be discussed:
- the recording;
- characterization of the speakers;
- specification of phonetic data;
- classification of pitch accents;
- peculiarities of individual accents in the given excerpt.

The specification of phonetic data gives maximum and minimum values for each speaker as regards reference levels (high, low, non-low), excursions (normal and large) and posttonic levels (high, low, non-low, midfield).
Note that no values can be given for the borderline between the high reference level and the midfield, which has been called the *non-high level* (see section 5.6.2). The level of this borderline depends on the highest point of types Rh- and Rm-, the difference between which has been described in sections 4.4 and 5.6.2. For the same reason the topline of the midfield cannot be indicated, but the level of that line is always situated high in the register. The bottom line of the midfield is the non-low reference level. Since realizations of types Fnl+ and Fnl- do not always reach exactly the non-low reference level in the tonic part, but may end up to a few semitones higher, the borderline between *non-low* and what has been called *above non-low* for type f-/+ is also indicated between brackets after the value for the non-low reference level. Note that realizations of type f-/+ sometimes nearly reach the non-low reference level, usually if a rising posttonic movement follows immediately.

The value for the non-low reference level indicates the end frequency for realizations of types Fnl- and Fnl+. The non-low reference level can be reached in the posttonic movement.
Pitch accents that reach the *low* reference level in the posttonic movement and are perceived as *low* do not belong to types Fnl- or Fnl+ but to Fl- or Fl+ (see also section 5.6.3).
The value for the *low* reference level is the lowest end frequency which is reached in realizations of types Fl- and Fl+. A fall which is perceived as a realization of type Fl- or Fl+ can end slightly higher than the value of the low reference level indicates. This is indicated between brackets after the value of the low reference level.
As has been discussed in chapter 5, there is no reason to indicate the slope for every type of pitch accent. Differences in slope can be perceived, but slope is not a feature distinguishing between different types of pitch accent. Individual cases in which slope seems to be a relevant feature for the description of a realization (e.g. emphatic accents) will be discussed separately.
The classification into types of pitch accent for each speaker will be given in tables of the type already presented in chapter 4 (tables 4.7 and 4.9) showing the results of the perception experiments.
Rising pitch accents high in the register are indicated with a capital R, and low in the register with a small r.
As has been discussed in chapter 5, there is a perceptually relevant difference between rising pitch movements that have their highest point high in the register and those that reach the highest point low in the register. An exact borderline between high and low in the register cannot be given, however. The range of high and low in the register not only varies for each speaker, but also in different fragments spoken by one speaker. The question is whether the borderline between high and low in the register is a discrete line. This problem concerns the relationship between what can be described perceptually in terms of reference levels and what in linguistics is called configurational vs. inherent features. Two rising pitch accents which are indicated with a capital R occur only high in the register: Rl- and Rh-, neutralized in Rø-. The problem is accents with a middle posttonic part. The subjects kept them apart on the basis of position in the register, so I have done the same for the entire corpus. But further experiments focused on the issue of whether or not a discrete borderline between high and low in the register exists are needed. (See also section 5.2.1.)
Falling pitch accents which reach the low or the non-low reference level are

indicated with a capital F, and falling accents which reach a level above the non-low reference level with a small f. Falling pitch accents preceded by a *zanos* are marked with an asterisk in the tables.
For other notational conventions see chapters 4 and 5.
In chapter 10 the pitch accents are numbered for each excerpt under the stylized pitch contours. The types of pitch accent are also given. In the examples and in the tables with classifications of rising and falling pitch accents for each speaker in the present chapter, the numbers of the accents correspond to those in chapter 10, which the reader may wish to consult while reading this chapter.

8.2 Selection of linguistic material

The linguistic material has been selected from existing recordings (prepared and quasi-spontaneous speech) and from my own recordings (spontaneous speech). The corpus contains excerpts of modern Russian speech that are representative of speech as we can hear it every day in the Russian speech community. A considerable part of the corpus therefore consists of spontaneous speech. I assume that a perceptual description of intonation based on spontaneous material can be applied to prepared speech which is read aloud, while the reverse does not hold true.
As will be discussed in this chapter, the intonation in prepared speech differs from that in spontaneous speech. In the latter, more representatives of different types of pitch accent and a richer variation in the realization of pitch accents can be found. But in order to make the overview of types of pitch accent as complete as possible, i.e. complete within a limited corpus, prepared speech was also included.
The material was selected from longer excerpts of speech according to the following criteria.
First, an excerpt was qualified as *spontaneous*, *quasi-spontaneous* or *prepared* speech.
Speech is called *spontaneous* if it is uttered in free discourse about an unprepared or unexpected subject, without any text or any preparation.
I made the recordings of *spontaneous* speech myself in Moscow and Leningrad. I tried to create conditions in which the speakers felt at ease and I did not give them any rules, instructions or impose any restrictions. In dialogues, the speakers usually agreed among themselves about a subject. In the monologue I sometimes directed the story by asking questions. Speakers who were indeed

talking freely were selected. From the recordings, differing in duration from half an hour to two hours, depending on the speaker, excerpts were chosen on the basis of variation in intonation. Each excerpt tells a more or less rounded-off little story.
A subdivision was made into *spontaneous* and *quasi-spontaneous* speech, since speaker B. Pokrovskij had probably prepared his talk to some extent (see section 8.3).
The excerpt from the film "Korotkie vstreči" (see section 8.10) can also be called quasi-spontaneous, since it is a spontaneous performance of a prepared dialogue.
Prepared speech presupposes that a speaker reads a text. Excerpts of *prepared* speech have also been selected on the basis of criteria such as variation in intonation in some sort of story.
After selection of the linguistic material a corpus of about 15 minutes was ready for perceptual analysis.
At my request a group of five native Russian phoneticians and one "naive" native speaker noted down a description of the type of speech and a characterization of the speakers. They were not informed about the type of recording, but were asked to describe the genre and naturalness of speaking. Their opinions will be presented in the comments for each speaker.
The group identified all speakers as good representatives of (quasi) spontaneous or prepared speech. No deviations from standard pronunciation of Russian that might influence intonation were found. Deviations concerning (regional) pronunciation will be given in the comments.
The speech rate was judged as normal for all speakers. Peculiarities belonging to the idiosyncrasy of a speaker can, however, be observed. They will be discussed in the comments.
In the following subsections the source of the recordings, the names of the speakers and the duration of the excerpts in the corpus are given.
The integral text of the corpus in Cyrillic and in an English translation can be found in chapter 9.

8.2.1 Quasi-spontaneous speech

B.A. Pokrovskij, opera director, Moscow.
Monologue, 2 minutes.
Melodija Records 1968.

K.G. Muratova, film director and actress, Moscow.
V.S. Vysockij, actor, poet and singer, Moscow.
Dialogue from the film "Korotkie vstreči" (Brief encounters) by K.G. Muratova, 3 minutes, 1967.
Broadcast on BBC Two television,
31 October 1987.

8.2.2 Spontaneous speech

E.V. Cvetkova, teacher of Russian as a second language, Moscow.
Monologue, 1 minute.
Moscow, June 1985.

L.E. Kukol'ščikova, teacher of English phonetics, Leningrad.
K.M. Denisov, post-graduate student of English phonetics, Leningrad.
Dialogue, 2 minutes.
Leningrad, May 1986.

A.S. Asinovskij, dialectologist, Leningrad.
S.Ju. Panasjuk, electrical engineer, Leningrad.
Dialogue, 3 minutes.
Leningrad, October 1987.

All the recordings of spontaneous speech were made by me, using my own equipment.
I recorded Mrs. Cvetkova at her home, and the other speakers in the studios of the Faculty of Arts of Leningrad State University, which were kindly placed at my disposal.

8.2.3 Prepared speech

M.S. Gorbačev, Secretary General of the Communist Party and President of the USSR, Moscow.
Excerpt from a political speech, 1 minute.
Moscow, 2 November 1987.
Broadcast on Dutch television in the eight o'clock evening news ("NOS-Journaal").

B.Š. Okudžava, writer and singer, Moscow.
Performed excerpt from a novel, 1 minute.
Melodija Records 1984.

News reader, Moscow.
A weather report, 2 minutes.
Broadcast on Moscow television at 08.00 hours.
22 October 1987.

8.3 Boris Pokrovskij

The material is taken from a quasi-spontaneous monologue performed by opera director B.A. Pokrovskij.
From the original recording of about 40 minutes a selection was made of one longer excerpt with a high diversity in intonation (1min 40s). One phrase and one short excerpt (15s) were added because of some interesting configurations of pitch movements which were lacking in the longer excerpt but occur frequently in modern spoken Russian.
Though the speaker must have prepared his talk to some extent, since it has been published by Melodija Records, Pokrovskij improvises freely on his work as an opera director. This can be concluded from the frequent fluctuations in speech rate, the hesitations and pauses he makes at syntactically unexpected moments and his sometimes extreme expressiveness as well as his idiosyncrasies. The long elliptic utterances, the frequent inversion and the independence of intonation patterns from syntactic structure in the entire recording justify the decision to call this particular talk of Pokrovskij quasi-spontaneous.
Native speakers had earlier accepted this description of the speech of Pokrovskij (see Odé 1986). For this reason the excerpt spoken by Pokrovskij was not judged again by the group of natives.
In Odé (1986) the bold lines in the styliżed contours indicate the perceptually relevant pitch movements. In the present study, in contrast, the bold lines indicate the accented syllables in all excerpts, including Pokrovskij. In the 1986 version initial accents are described separately (Odé 1986: 434-435) and are not always marked in the stylized pitch contours. In the present study the same pitch accents as in the 1986 version have been maintained, but some accents now belong to another type of pitch accent as a consequence of new insights and the sorting experiment (section 4.2).

8.3.1 Specification of the phonetic data

The highest level reached is 270 hertz.
The lowest level is 70 hertz.
The largest excursion is 23.4 semitones, measured from the lowest level.
There are 113 pitch accents in the excerpt: 71 rising and 42 falling accents.
In chapter 10 the Pokrovskij excerpt is presented in 30 lines of stylized pitch contours.

type	pitch accent number
Fl-	33, 44, 46, 52, 66, 79
Fnl-	64, 75
Fl+	8*, 15*, 61*, 70, 81, 85, 91*
Fnl+	37, 38, 68, 86, 87*, 88, 92, 104*, 109
Fh-	83, 84, 108, 111, 113
F^n+	93*, 94*, 95*, 96*, 97*
f-/+	6, 7, 22, 34, 47, 48, 58, 110

Table 8.1: Falling pitch accents in Boris Pokrovskij

type	pitch accent number
Rl-	2, 5, 11, 12, 49, 100, 106
Rh-	13, 30, 56, 72, 73
Rø-	35, 39, 40, 45, 76
Rm-	1, 3, 10, 14, 16, 17, 31, 32, 41, 42, 43, 50, 51, 55, 59, 60, 63, 67, 80, 98, 99, 101, 107
Rm+	9, 36, 53, 54, 57, 62, 69, 71, 77, 78, 82, 102, 103, 105
rm-	18, 20, 23, 24, 26, 28, 29, 112
rm+	4, 19, 21, 25, 27, 65, 74, 89, 90
rl-	
rl+	

Table 8.2: Rising pitch accents in Boris Pokrovskij

In tables 8.1 and 8.2 the features indicate the following values:
- large excursion (R): 11-23.4 ST (measured from the low reference level);
- normal excursion (r): 0-11 ST (measured from the low reference level).

The subdivision of the whole field between high and low has been established as follows:
- the low level (l): 70 hertz = 0 ST;
- the high level in R (h): 270 hertz = 23.4 ST above 70 hertz;
- the non-low level (nl): about 80 hertz = about 3 ST above 70 hertz;
- the midfield (m): above about 80 hertz = above about 3 ST above 70 hertz;
- high register (R): 130-270 hertz;
- low register (r): 70-130 hertz.

8.3.2 Comments on individual pitch accents

Pokrovskij's speech has been commented upon in section 3.5. In my present classification the description of falling movements differs from my first classification in Odé (1986). These differences have been discussed in chapters 4 and 5. In this section a few remarks will be made with respect to Pokrovskij's movements.
Pokrovskij makes a wonderful harmonica pattern in nos. 93-97, described in section 3.5. This pattern is one of my favourite issues in Russian intonation. Russian teachers, normative-minded linguists and phoneticians still recommend that this pattern should be avoided because, as they say, it belongs to vernacular speech, which must be understood as a pejorative characterization, as the speech of "simple" people. In Russian this style is nicely called *prostorečie* (literally: simple speech). Despite the fact that the pattern is realized in the speech of native Russians of all sorts and conditions (including speakers such as news readers, who are supposed to use normative standard Russian) teachers, linguists and phoneticians reject the pattern. They do not like to be confronted with their own harmonicas if I catch them out making the pattern. What is wrong with the harmonica? It seems to be one of the taboos left, though spontaneous speech is now a fully recognized item in Soviet linguistics, phonetics and literature.
Although they form a sequence of type Fnl+/Fl+ , nos. 85-88 do not form a harmonica pattern: pitch does not rise immediately after the fall. A harmonica in these accents would be perceived if there were rises in the first posttonic syllables, followed by falls in the second posttonic syllables. Such examples constitute an argument for keeping the harmonicas apart (see the discussion in section 4.6).
Accent no. 38 has been classified as realization Fnl+ though it does not reach the non-low reference level, not even in the posttonic syllables. Yet it was

clearly perceived as an Fnl+, probably because the posttonic syllables are level and do not connect the fall with the next pitch accent: there is a prosodic boundary between accents nos. 38 and 39.
An interesting realization of type Fh- is no. 83. The rising movement starts in the accented syllable, preceded by a low level in the pretonic syllable. The accent belongs to the same type as the next accent, no. 84, where the rising movement is located in the posttonic syllables. Visual comparison of accents nos. 83 and 84 would not suggest that they belong to the same type.
A fine example of a parenthesis in a reduced span is given in nos. 6-8.
Type Rø- in principle has early timing, but in one case in Pokrovskij the rise is only half-way at the vowel onset: no. 76 (*i togda*). Yet it is perceived as a realization Rø-, probably because the actual excursion of the movement is very large (20.6 ST) and the slope is steep.
Accent no. 98 (Rm-) has early timing and no posttonic syllables. Yet the accent does not belong to type Rø-: it can be perceived that there is no neutralization of types Rl- and Rh-, because the beginning of the falling movement can be heard in the tonic syllable.
A deviating rising pitch accent in Pokrovskij is no. 82 (Rm+) in the word *lučše*. In fact both syllables are pitch-accented: in the syllable with word stress *lu-* pitch rises, in *-čše* the falling movement starts at the vowel onset of the posttonic syllable in a steep movement. It is an emphatic accent, which can be explained by the fact that the accent has a delayed peak and the vowel in the posttonic part starts at a higher level than the end of the accented vowel. Though this accent has some similarity with the harmonica pattern, for which reason it has been paired with a harmonica in the classification experiment (see section 4.6), the accent did not cluster with other harmonicas: in test 1 many shift marks were put between the first harmonica and the next assumed harmonica; in test 2 in a pair of two assumed harmonicas the pair was marked as dissimilar; and in test 3, where the subjects were asked to insert punctuation marks, the result was many question marks and one exclamation mark. In the context, however, the accent did not mark a question at all.
Type Rl- realization no. 5 is exceptional, because the low posttonic part is usually realized in the posttonic syllable, but there is no posttonic syllable in the word Sad*ko*. The posttonic low part is reached at the end of the final lengthened accented syllable (compare, for example, type Rø-, no. 35).
No. 25 is an example of a pitch accent in an afterthought.

8.4 Larisa Kukol'ščikova and Konstantin Denisov

The excerpt has been selected from a long spontaneous dialogue performed by a professor of English phonetics, Larisa Kukol'ščikova, and a so-called aspirant (post-graduate student) preparing his candidate dissertation on English intonation, Konstantin Denisov.
I made the recording in a small studio at the Department of Phonetics of Leningrad State University. In order to create a good atmosphere for the conversation I did nothing special to prepare the speakers for the recording. This ensured that the speaking situation was as natural as possible under the circumstances.
Larisa and Konstantin had a free conversation on subjects of their own choice. In the excerpt the problem of grandparents looking after their grandchildren is discussed.
Konstantin had some trouble speaking spontaneously, but Larisa chats absolutely naturally, spontaneously, unhampered by the microphones. Sometimes they wobbled on their chairs and then did not always keep the same distance from the microphone. They were laughing, raising their voices, interrupting each other and not letting the other finish. This made it impossible to use the whole excerpt that I had selected for the analysis: some fragments had to be left out.
The speakers were characterized by the native judges as follows.
Larisa Kukol'ščikova: very natural, colloquial speech, sometimes a little constrained.
Konstantin Denisov: not always natural, imitates an interview style, plays a role, is constrained, emotionally at a distance from the subject.
On the whole the dialogue was considered to be a fairly natural conversation between highly educated people.

8.4.1 Specification of the phonetic data

There are 151 pitch accents in the excerpt: 86 rising and 65 falling accents.
In chapter 10 the excerpt is presented in 34 lines of stylized pitch contours. A new line starts when each speaker talks in turn.
Larisa Kukol'ščikova:
The highest level reached is 416 hertz.
The lowest level is about 100 hertz.
The largest excursion is 24.7 semitones measured from the lowest level.

type	pitch accent number
Fl-	
Fnl-	119, 129
Fl+	30*, 100
Fnl+	10, 78*, 82, 86, 91*, 95*, 96*
Fh-	7, 139, 140
F^n+	
f-/+	2, 3, 15, 16, 17, 19, 20, 22, 23, 24, 25, 72, 74, 83, 110, 113, 115, 118, 130, 131, 134

Table 8.3: Falling pitch accents in Larisa Kukol'ščikova

type	pitch accent number
Rl-	21, 73, 75, 81, 84, 132
Rh-	28, 29
Rø-	27, 79, 87, 97, 111, 116, 120
Rm-	5, 6, 80, 112, 121, 122, 123, 124, 125, 133
Rm+	1, 4, 8, 26, 76, 77, 85, 88, 89, 90, 98, 117, 138
rm-	18, 99, 114, 126
rm+	9, 127, 128
rl-	
rl+	

Table 8.4: Rising pitch accents in Larisa Kukol'ščikova

In tables 8.3 and 8.4 the features indicate the following values:
- large excursion (R): 12 - 24.7 ST;
- normal excursion(r): 0 - 12 ST.

The subdivision of the whole field between high and low has been established as follows:
- the low level (l): 100 (109) hertz = 0 (1.5) ST;
- the high level in R (h): 416 hertz = 24.7 ST above 100 hertz;
- the non-low level (nl): 120 (128) hertz = 3.2 (4.3) ST above 100 hertz;
- the midfield (m): above 120 hertz = above 3.2 ST above 100 hertz;
- high register (R): 200 - 416 hertz = 12 - 24.7 ST above 100 hertz;
- low register (r): 100 - 200 hertz = 0 - 12 ST.

Konstantin Denisov:
The highest level reached in pitch is 243 hertz.
The lowest level is 90 hertz.
The largest excursion is 17.2 semitones measured from the lowest level.
In tables 8.5 and 8.6 the features indicate the following values:
- large excursion (R): 10 - 17.2 ST = 180 - 243 hertz;
- normal excursion (r): 0 - 10 ST = 90 - 180 hertz.
The subdivision of the whole field between high and low has been established as follows:
- the low level (l): 90 (106) hertz = 0 (2.8) ST;
- the high level in R (h): 243 hertz = 17.2 ST above 90 hertz;
- the non-low level (nl): 106 (116) hertz = 2.8 (4.4) ST above 90 hertz;
- the midfield (m): above 106 hertz = above 2.8 ST above 90 hertz;
- high register (R): 180 - 243 hertz;
- low register (r): 90 - 180 hertz.

type	pitch accent number
Fl-	93
Fnl-	
Fl+	109
Fnl+	11, 33, 38, 47, 50, 60*, 67, 71*, 101*, 106, 136*, 137, 142
Fh-	41, 58, 135
F^n+	
f-/+	34, 36, 40a, 54, 55, 62, 65, 102, 103, 104, 105, 107

Table 8.5: Falling pitch accents in Konstantin Denisov

8.4.2 Comments on individual pitch accents

In Larisa's speech there are only two falling pitch accents which reach the low reference level: nos. 30 and 100. The phenomenon of not coming down in falling movements is characteristic of spontaneous speech. After the Fl+ falls Kostja uses the opportunity to take his turn. No. 91, which has been classified as a non-low fall, reaches a point almost as low as nos. 30 and 100, yet it is perceived as non-low: the timing is late and the accented syllable is also a final open syllable. After this accent Kostja takes over.
One type Fnl+ realization, no. 96, does not reach the non-low reference level:

type	pitch accent number
Rl-	64, 94
Rh-	42, 48, 92
Rø-	53, 70, 108, 144
Rm-	39, 43, 44, 45, 66
Rm+	31, 40b, 51, 52, 68
rm-	61, 63, 141, 145, 146, 148, 149, 150
rm+	12, 13, 14, 32, 35, 37, 46, 56, 57, 59, 143, 147
rl-	49
rl+	69

Table 8.6: Rising pitch accents in Konstantin Denisov

its lowest point lies 3.4 ST above non-low. The reason for classifying this accent as a type Fnl+ is as follows. Larisa answers Kostja's question almost laughing; she seems to switch to a much higher position in the register, with other reference levels. The movement has a *zanos*, is extremely steep and the vowel onset is near the beginning of the fall: many features that differ from a type f-/+ realization.

In nos. 133-134 Larisa finishes the utterance laughing high in the register. The rising posttonic movement has been drawn, but in fact she speaks and laughs simultaneously.

An interesting realization of type Fh- is no. 139. The falling movement and the low plateau are situated in the pretonic syllable. The rising movement takes place in the accented syllable, followed by a high level part in the posttonic syllable. The next pitch accent, no. 140, is of the same type but realized in a more usual way: the falling movement in the pretonic syllable, the low plateau in the accented syllable and the rising movement and the high level located in the posttonic syllable. The only other type Fh- realization is no. 7. In this case the low plateau is absent: the turning point is at the beginning of the posttonic syllable. Though not a prototypical type Fh- realization, it was nevertheless perceived as belonging to this type (it was one of the stimuli in the classification test, see section 4.6).

Realizations of a *zanos* before a type Fnl+/Fl+, nos. 30, 78, 91, 95 and 96, are very clear in Larisa's speech. In no. 95 she makes both *zanos* and fall in the (normally) monosyllabic word *net* in which she pronounces the vowel as two syllables: [ijɛ].

In Kostja's speech there is one feature which immediately strikes the listener:

he sounds lazy. As mentioned above, Kostja has been characterized as a not very spontaneous speaker. He does his utmost to keep the conversation going, but with an eager speaker like Larisa there was no need to do this at all. Differences between Larisa and Kostja are immediately obvious, for instance, when the pitch accents nos. 120-129 of Larisa and nos. 145-150 of Kostja are compared.

Except in a few cases, both falling and rising movements in Kostja's speech do not exceed a steepness of 60 semitones per second. Though not an independent distinctive feature, the slope of movements can be an idiosyncratic characteristic of a speaker and in this case it creates the impression of laziness. Movements with a slope of more than 60 ST/s in Kostja's speech almost all have late timing: a means of realizing an emphatic accent (see section 5.4).

A feature of type f-/+ realizations is that they reach a lowest point situated *above* the non-low reference level. But in nos. 102-105 the non-low reference level is reached, yet a type f-/+ is perceived. This can be explained as follows. After the accents nos. 102-105 the posttonic parts are not falling but rising movements, and there is no boundary after the accents. The accents belong to the sawtooth pattern realized in a reduced span at a low level in a parenthesis (see also section 5.4.2).

Accents nos. 41 and 135 have been classified as Fh- realizations. In no. 41 the falling movement is situated in the pretonic syllables, while pitch already rises in the accented syllable. In Fh- realizations it is usually the posttonic syllables which rise. In accent no. 135 the falling movement is also located in the pretonic syllable, which is very long and in itself almost accented. The vowel onset of the accented syllable is situated at the turning point from which pitch rises. The accents are perceived as a type Fh- realization because of the rising posttonic part and the following high level.

Most of the rising pitch accents in Larisa's speech are located high in the register.

Posttonic movements ending in the midfield can be situated in syllables after the accented one in the same word (e.g. no. 122) or over a word boundary (e.g. no. 124). But sometimes a word boundary marks a prosodic boundary as well. An example is no. 120. It is a type Rø- realization and not type Rh- because the final syllable is accented: pri*čem*. If the next word "ešče" were grouped together prosodically with the word "pričem", the pitch accent would be of type Rm-. Though there is no pause between the words, the boundary is perceived clearly.

A more or less comparable case is no. 75. It has been classified as a type Rl-

realization, but it competes for type Rm- as well. The posttonic movement, over a word boundary, ends low in the midfield: type Rm- then? The posttonic movement ends too low in the midfield and is too steep to belong to type Rm-: hence type Rl-.
Another case is no. 79, which belongs to type Rø-: pitch accent no. 79 in the monosyllabic word "*nam*" is immediately followed by another pitch accent in the first syllable of the next word ("*nužno*"), which belongs to type Rm-. There is no prosodic boundary between the two accents.
Almost similar to the cases mentioned is accent no. 84, but now the accent is a type Rl- realization because there is a posttonic low point in the same word at a prosodic boundary and it is only after this low point that pitch rises again to the next accent.
Rise no. 28 is perceived as a type Rh- realization in the utterance, but if we isolate the accent with the posttonic syllables from the next pitch accent a falling posttonic movement can be perceived.
In the utterance with accents nos. 87-90 all rises are late and have a large excursion. All words have a pitch accent. As a whole the utterance is therefore perceived as emphatic.
In the utterance with accents nos. 120-129 all syllables with word stress have a pitch accent, except the word *"ešče"*. The utterance as a whole shows declination.
Realizations of type Rø- sometimes have late timing: nos. 27, 87, 97, 116 in Larisa's speech and nos. 108 and 144 in Kostja's speech. Yet these accents belong to type Rø-: the highest point may be reached late, but the pitch level of the movement at the vowel onset is high enough for the accent to be perceived as a neutralization between types Rl- and Rh-.
In Kostja's speech, type Rl- realization no. 64 has a gradually falling posttonic part which gives the impression of ending in the midfield, but the posttonic part is too low for a type Rm-, and is, in fact, low enough for type Rl-.
Nos. 49 and 69 have been classified into type rl- and rl+ despite the fact that the posttonic level is not really low. The falling movement in the posttonic syllable has a slope so steep that it can be perceived as reaching a low level.
Examples of the sawtooth pattern can be found in utterances with accents nos. 54-57 and nos. 102-105.
A feature which the other rising pitch accents have in common with the falling accents is the fact that the gradual slope is responsible for the drawling speech of Kostja.

8.5 Elena Cvetkova

I recorded this spontaneous monologue at Cvetkova's home in Moscow. Elena Cvetkova is a linguist and teacher of Russian pronunciation and intonation for advanced foreign students and teachers of Russian language and literature at the Puškin Institute in Moscow. She is in her thirties and has always lived in Moscow. According to specialists in the field of regional pronunciation of Russian, Cvetkova has a typical Moscow pronunciation. But this statement must be qualified. Since she is a teacher of pronunciation she is a living example of what has to be taught as literary Moscow pronunciation, the normative standard. Departing from this pronunciation, she tends to realize the vowel-grapheme e, in stressed position pronounced as [e] but in pretonic position reduced to [I] in Moscow pronunciation, as [e] in the latter position, which is Leningrad or northern pronunciation. This phenomenon is called ékan'e (in contrast with ikan'e) and is, for example, discussed by Panov (1967: 511-518). Cvetkova is aware of this fact. Her explanation is that otherwise foreign students sometimes spell the words concerned incorrectly, especially in these cases. Moreover, she makes palatalized consonants hard, for instance the [r], and sometimes also does this with consonants in the infinitive verb forms. These "deviations" have no influence on intonation, however.
Intonational peculiarities of this pronunciation are as follows.
One of the main features of Moscow pronunciation compared with Leningrad pronunciation, besides ikan'e versus ékan'e, is the tendency to lengthen both accented and pretonic unaccented vowels, to reduce unaccented vowels more and to reduce the excursion of pitch accents. Longer accented vowels plus smaller excursions seems contradictory, as does shorter accented vowels plus larger excursions. Yet this is an important distinction between Moscow and Leningrad pronunciation. For a discussion see Verbickaja (1976).
The recording can be called spontaneous. I had been listening to colourful stories for hours. The recorder was running all the time and Cvetkova seemed to have forgotten about it completely. Her speech is recognized as truly spontaneous: the group of native speakers has described Cvetkova's speech as natural, with some embarrassment, recorded in an informal atmosphere.

8.5.1 Specification of the phonetic data

The highest level reached is 384 hertz.
The lowest level is 140 hertz, but Cvetkova hardly ever reaches this level.

The largest excursion is 17.5 semitones measured from the lowest level. There are 68 pitch accents in the excerpt: 44 rising and 24 falling accents. In chapter 10 the excerpt is presented in 17 lines of stylized pitch contours.

type	pitch accent number
Fl-	3*, 39*
Fnl-	50*, 62
Fl+	7*
Fnl+	1, 4*, 10, 11, 17*, 40, 43, 67
Fh-	
F^n+	
f-/+	12, 23, 24, 37, 38, 45, 53, 54, 58, 61, 65

Table 8.7: Falling pitch accents in Elena Cvetkova

type	pitch accent number
Rl-	5, 13, 20, 22, 27, 46, 49, 56
Rh-	31, 35
Rø-	25, 29
Rm-	6, 8, 9, 14, 36, 42, 59, 64, 66
Rm+	30, 51
rm-	15, 18, 21, 26, 28, 32, 33, 44, 48, 55, 60, 63, 68
rm+	2, 19, 34, 41, 52
rl-	16, 47, 57
rl+	

Table 8.8: Rising pitch accents in Elena Cvetkova

In table 8.7 and 8.8 the features indicate the following values:
- large excursion (R): 10 semitones or more;
- normal excursion (r): 10 semitones or less;
- high register (R): 250 - 384 hertz = 10 - 17.5 ST;
- low register (r): 140 - 250 hertz = 0 - 10 ST;

For both table 8.7 and table 8.8 the following subdivision between high and low was found:
- the low level (l): 140 hertz = 0 ST;
- the high level in R (h): 384 hertz = 17.5 ST above 140 hertz;

- the non-low level (nl): 161 (178) hertz = 2.4 (4.2) ST above 140 hertz;
- the midfield (m): above 161 hertz = above 2.4 ST above 140 hertz.

8.5.2 Comments on individual pitch accents

In every case the 24 falling pitch accents have a gradual slope of only 51.4 semitones per second or less.
The timing is early in 5 cases and late in 19 cases.
The falling accents do not reach the lowest level of the speaker, except in three cases with a preceding *zanos* (nos. 3, 7 and 39). The other 21 accents, which do not reach the lowest level, show a *zanos* in 3 cases: nos. 4, 17 and 50. No. 50 is continued in the posttonic syllables on a level situated in the midfield: the excursion in the accented syllable is very small. The end frequency is located 8.7 ST above the low level, yet it can be perceived as type Fnl+ , probably because of the preceding *zanos*.
The rising pitch accent in no. 9 functions simultaneously as a *zanos*: the fall in no. 10 follows immediately (see also Gorbačev, nos. 26/27 and Okudžava nos. 21/22 and 27/28).
Accents nos. 13, 20, 22, 27, 46 and 49 have been classified as types Rl-, but the posttonic level is not really low, which is characteristic of Cvetkova's speech and of spontaneous speech in general.
No. 55 is a doubtful accent, because it is not clear which word has a pitch accent: *čto* or *my*.
No. 68 is a small accent after a last accent. The same type of accent can be observed in Okudžava, for instance no. 84.
The pretonic vowel is sometimes long in Cvetkova's speech. Examples are the pretonic parts before accents nos. 3 (180 ms) and no. 7 (100 ms). In no. 7 the tonic vowel is very long (300 ms). In no. 4 the pretonic vowel is long, but the tonic vowel short. In the three examples mentioned, Cvetkova realizes a *zanos*.
In standard literary Russian unstressed vowels are determined by two features: a reduction of vowel quality and a reduction of vowel duration (Bondarko 1977: 155). The reduction of vowel duration depends on the position of the unstressed vowel. The pretonic vowel is longer than the pre-pretonic vowel and shorter than the tonic vowel. However, in Moscow pronunciation the pretonic vowel can be as long as or even longer than the tonic vowel, whereas in the pre-pretonic vowel the duration is shorter (Rozanova 1988). This peculiarity of Moscow pronunciation can be observed in Cvetkova's speech. Probably a long pretonic vowel is also the cue responsible for the perception of Cvetkova's

speech as lazy and as Moscow pronunciation. Moreover, most non-low falls have a late timing and a gradual slope; the effect for the hearer is that of a never-ending story. This drawling seems, if not only idiosyncratic for this speaker, a peculiarity of many a Moscovian speaker.
The pitch range is somewhat smaller than for the other speakers in the corpus; large movements hardly occur. The few rises with large excursion have a steep slope in four cases. Of the 44 rises there are 5 steep and 39 gradual movements. Moreover, most posttonic syllables end in the midfield. The gradual slope and the posttonic endings in the midfield contribute to the drawling effect. Only nine rises are located high in the register, i.e. between 10 and 17.5 semitones above the lowest level (between 250 and 384 hertz).
Characteristic of colloquial speech are utterances like *tak vot tak vot tak mol i tak* (nos. 24 and 25).
Rise no. 35 is a continuation of rise no. 34: no. 35 starts at the end frequency of no. 34. Yet no. 34 is perceived as a pitch accent and not as a pretonic part of accent no. 35.
In the utterances with accents nos. 56-62 Cvetkova seems to imitate her own intonation, as if she were again talking to the woman she is telling about, but after a shy laugh she continues in a more lively manner, speaking more freely in nos. 63-68.

8.6 Aleksandr Panasjuk and Aleksandr Asinovskij

I recorded this spontaneous dialogue myself in Leningrad. In a slow, restrained start the two Saša's discussed what a spontaneous dialogue is supposed to be, saying that circumstances cannot be created for real spontaneous behaviour, since it all depends on the mood and atmosphere at the very moment of recording. Then, suddenly, Saša Panasjuk remembered a story that he had not yet told Saša Asinovskij. The somewhat reserved tone disappeared and at this moment the selected excerpt starts.
The dialogue has been identified as real natural spontaneous speech without any deviations. For technical reasons some parts have not been analysed: the speakers were sometimes talking simultaneously or interrupting each other without waiting for a pause or silence. These parts are left out in the following sections of the comment.
The speech rate is fairly high, but not extremely so.
The group of native speakers described the excerpt as a very natural, spontaneous dialogue between friends. However, Saša Asinovskij himself and one

of the phoneticians rated Asinovskij's speech as an imitation of spontaneous speech. In the excerpt Asinovskij is present in just a few reactions. In order to tell the two Saša's apart, Asinovskij's text is printed between brackets in chapter 10.

8.6.1 Specification of the phonetic data

There are 215 pitch accents in the whole excerpt: 108 rising and 107 falling accents.
In chapter 10 the excerpt is presented in 40 lines of stylized pitch contours.

Saša Panasjuk:
The highest level reached by Saša Panasjuk is 263 hertz.
The lowest level is 65 hertz.
The largest excursion is 24.5 semitones measured from the lowest level.

type	pitch accent number
Fl-	9*, 15, 17, 48, 49, 66, 90, 96, 109*, 210
Fnl-	3, 42, 43, 55*, 131*, 147
Fl+	31, 33, 62, 70, 97, 98, 122, 129, 141, 167, 198, 203, 209
Fnl+	54, 81, 82, 85, 86, 87, 104, 112, 117, 134, 135, 137, 140, 143*,144*, 145*, 170, 178, 185, 186, 193, 208, 212, 213, 215
Fh-	45, 181
F^n+	
f-/+	5, 7, 8, 23, 24, 25, 57, 58, 74, 75, 76, 77, 79, 84, 91-92, 94, 118, 139, 146, 148, 150, 151, 152, 156, 160, 161, 164, 165, 168, 169, 188, 189, 191, 195, 205

Table 8.9: Falling pitch accents in Saša Panasjuk

In table 8.10 the features indicate the following values:
- large excursion (R): 12 semitones or more;
- normal excursion (r): 12 semitones or less;
- high register (R): 130 - 263 hertz = 12 - 24.5 ST;
- low register (r): 65 - 130 hertz = 0 - 12 ST;

For both table 8.9 and table 8.10 the following subdivision between high and low was found:

type	pitch accent number
Rl-	1, 13, 26, 29, 44, 50, 52, 88, 111, 128, 171, 192, 206
Rh-	89, 159, 177, 184
Rø-	30, 41, 59, 60, 78, 113, 196, 202, 207, 211, 214
Rm-	6, 18, 20, 21, 28, 37, 46, 47, 51, 56, 63, 69, 71, 72, 80, 93, 110, 115, 116, 132, 133, 138, 142, 153, 162, 163, 172, 173, 174, 187, 194, 197, 199, 200, 201
Rm+	4, 12, 19, 22, 27, 53, 61, 64, 68, 73, 83, 127, 130, 136, 154, 155, 190
rm-	2, 14, 16, 32, 34, 35, 36, 38, 39, 40, 95, 121, 157
rm+	65, 158, 166, 204
rl-	149
rl+	

Table 8.10: Rising pitch accents in Saša Panasjuk

- the low level (l): 65 (76) hertz = 0 (2.7) ST;
- the high level in R (h): 263 hertz = 24.5 ST above 65 hertz;
- the non-low level (nl): 76 (96) hertz = 2.7 (6.8) ST above 65 hertz;
- the midfield (m): above 76 hertz = above 2.7 ST above 65 hertz.

Saša Asinovskij:
The highest level reached by Saša Asinovskij is 303 hertz.
The lowest level is 95 hertz. It is hard to say whether 95 hertz is indeed this speaker's lowest level, since he does not talk much in the excerpt.
The largest excursion is 20.1 semitones measured from the lowest level.

type	pitch accent number
Fl-	
Fnl-	103, 126
Fl+	176, 182
Fnl+	67, 114, 120, 180
Fh-	
F^n+	
f-/+	11, 99, 100, 101, 106, 123, 183

Table 8.11: Falling pitch accents in Saša Asinovskij

type	pitch accent number
Rl-	102, 119, 124
Rh-	
Rø-	125
Rm-	175
Rm+	
rm-	105, 107, 108
rm+	10, 179
rl-	
rl+	

Table 8.12: Rising pitch accents in Saša Asinovskij

In tables 8.11 and 8.12 the features indicate the following values:
- large excursion (R): 12 semitones or more;
- normal excursion (r): 12 semitones or less;
- high register (R): 180 - 303 hertz = 12 - 20.1 ST;
- low register (r): 95 - 180 hertz = 0 - 12 ST;

For both table 8.11 and table 8.12 the following subdivision between high and low was found:
- the low level (l): 95 (106) hertz = 0 (1.9) ST;
- the high level in R (h): 303 hertz = 20.1 ST above 95 hertz;
- the non-low level (nl): 109 (138) hertz = 2.4 (6.5) ST;
- the midfield (m): above 109 hertz = above 2.4 ST above 95 hertz.

8.6.2 Comments on individual pitch accents

Declination is almost absent in this dialogue.
There are some interesting utterances in which the same words are repeated by the same speaker. No. 45 (Fh-) is followed by a hesitation (*gm*), after which the same words *a obratno* are repeated in no. 46 with another accent: Rm-. (See also a similar case in the weather report: nos. 40 and 41.) Other repetitions are nos. 70 and 71-72 (*sledujuščij den'*), nos. 78 and 83 (*v sem' utra*) and nos. 111 and 113 (*v Svijažsk*).
In the utterance with accents nos. 95 and 96 Panasjuk makes a statement. Asinovskij repeats the same words teasingly in question form in accents nos. 102 and 103.

An example of an afterthought in this excerpt is no. 134: *ėta štuka takaja.* After accent no. 154 Panasjuk continues without much enthusiasm and Asinovskij hums and haws more often, until suddenly Panasjuk remembers another interesting detail (accent no. 161 *da*) after which he interrupts himself and tells in a more lively manner what was about to happen, but Asinovskij has already guessed: *vydelili rejs* (nos. 175 (Rm-) and 176 (Fl+)), repeated by Panasjuk twice (nos. 177-178 and 184-185) with other types of pitch accent: Rh- and Fnl+ in both cases.

In no. 181 pitch falls (f-/+) and rises (rm+) in the monosyllabic word *da.* The accent has been classified into type Fh- despite the position of the movement above non-low. The rising movement after the low plateau in the configuration can be perceived clearly. This type of accent can frequently be observed in a confirming function in words like *da* (yes), *konečno* (of course) but also in humming and hawing.

The sequence of realizations of type Fnl+ and Fl+, nos. 143-145, resembles a harmonica pattern. Yet I did not classify the accents into type F^n+ because one characteristic feature is missing: the sequence does not end with a rising posttonic part, but continues in a regular sawtooth pattern.

The difference between types Fl+ and Fl- (timing) can clearly be heard in nos. 62 and 66 in the same utterance in the same word *vernut'sja.* Here, both realizations have the same end frequency: 68 hertz.

Saša Panasjuk frequently uses the word *vot* as a stopgap to start or finish an utterance. Except in no. 4, where *vot* is not a stopgap, in every case where a pitch accent is realized in *vot* the same falling movement can be observed: Fnl+ in accents nos. 104, 135, 186, 193 and f-/+ in nos. 91-92). In Cvetkova's speech we find the same movement in *vot*: nos. 11 and 40. Further stopgaps in Panasjuk are *čego-to takoe, voobšče, nu to est'*: the pitch accents in these words are also realizations Fnl+ or f-/+: nos. 75-76, 165, 84-85.

In this excerpt, which is perhaps the best example of spontaneous speech in the corpus, there are many filled and unfilled pauses. I will list a few examples.

Between accents nos. 2 and 3 Panasjuk hums and haws in the vocal fry. Therefore the accents have not been connected. An unfilled pause can be found between accents nos. 8 and 9. It is interesting to see that humming and hawing occurs before an unfilled pause as well as after a silence (the silence is indicated by ...):

ėtogo... gm parochodika (before no. 26),

gm... stoim ždem značit (before no. 27).

A fine example of a sawtooth pattern in a reduced span can be found in the utterance with accents nos. 38-40.
Accent no. 121 has been classified as type rm+, but the actual rise is a virtual movement that takes place before the voice onset.
In the utterance with rise no. 50 Panasjuk laughs.
The speech rate is very high in the utterance with accents nos. 68-74. Reading the text we find 23 syllables pronounced in 2.5 seconds, of which Panasjuk swallows only two, in the word *značit*.
A type of stopgap is the word *nu*, always realized with a rising movement: in Panasjuk nos. 127, 130, 138, 142; in Okudžava nos. 21 and 27 (see section 8.9), in the weather report no. 47 (see section 8.7).

8.7 Weather report

The weather report was recorded directly from Moscow television. The report was partly read from a written text, but on the whole it can be characterized as a "free style" report, that is, the speaker does not read but tells the text and addresses the listener as in an eye-to-eye conversation. As far as I remember from the period before Gorbačev the style of such reports has never been that free.
Some native speakers have described the speech of the newsreader as being too colloquial, but others typified him as a natural newsreader.

8.7.1 Specification of the phonetic data

The highest level reached is 204 hertz.
The lowest level is 65 hertz.
The largest excursion is 19.8 semitones measured from the lowest level.
There are 164 pitch accents in the excerpt: 116 rising and 48 falling accents.
In chapter 10 the excerpt is presented in 32 lines of stylized pitch contours.
In table 8.14 the features indicate the following values:
- large excursion (R): 12 semitones or more;
- normal excursion (r): 12 semitones or less;
- high register (R): 130 - 204 hertz = 12 - 20 ST;
- low register (r): 65 - 130 hertz = 0 - 12 ST;

For both table 8.13 and table 8.14 the following subdivision between high and low has been found:
- the low level (l): 65 (74) hertz = 0 (2.3) ST;

- the high level in R (h): 204 hertz = 19.8 ST above 65 hertz;
- the non-low level (nl): 74 (98) hertz = 2.3 (7.1) ST above 65 hertz;
- the midfield (m): above 74 hertz = above 2.3 ST above 65 hertz.

type	pitch accent number
Fl-	12, 25, 46*, 68*, 80, 87, 100, 112, 147, 164
Fnl-	22, 36, 99, 103, 114, 136, 142
Fl+	31*, 156
Fnl+	2, 3, 8, 53*, 108, 121, 126
Fh-	40
F^n+	
f-/+	5, 6, 7, 9, 19, 20, 29, 37, 38, 55, 79, 85, 86, 89, 102, 110, 117, 144, 149, 155, 158

Table 8.13: Falling pitch accents in the weather report

type	pitch accent number
Rl-	18, 32, 56, 61, 81, 91, 113, 160
Rh-	1, 10, 21, 23, 41, 42, 84, 116, 122, 132, 134, 150, 151
Rø-	11, 34, 133, 139
Rm-	15, 16, 17, 26, 27, 30, 33, 35, 39, 47, 48, 49, 50, 51, 52, 59, 65, 69, 72, 73, 74, 82, 83, 90, 95, 96, 101, 104, 106, 109, 111, 127, 128, 137, 138, 148, 152, 157
Rm+	13, 14, 43, 54, 57, 64, 97, 123, 124, 129, 135, 153
rm-	4, 24, 28, 44, 58, 62, 63, 66, 75, 76, 77, 78, 88, 92, 93, 94, 105, 115, 118, 119, 120, 130, 141, 143, 145, 161, 162, 163
rm+	45, 60, 67, 70, 71, 98, 107, 125, 131, 146, 154, 159
rl-	140
rl+	

Table 8.14: Rising pitch accents in the weather report

8.7.2 Comments on individual pitch accents

In the utterance with accents nos. 40 (Fh-) and 41 (Rh-) the same word is repeated after an interruption by the newsreader himself: *i vozmožno ja govorju*

vozmožno. The same phenomenon was observed in the speech of Panasjuk (nos. 45 and 46). No. 40 has been classified as type Fh- and perceptually it does belong to this type. But the picture clearly shows that the rising movement starts in the accented syllable and not in the posttonic syllable.
After accent no. 69 the newsreader turns to the typical standard weather report style, because from there on he is reading facts. Most specific for this style are the utterances with accents nos. 101-112.
There are many sawteeth in this excerpt, with rising pitch accents that are followed by a type Fl- accent, for instance nos. 23-25, 42-46, 74-80, 84-87, 97-100. Sawteeth with rising or falling pitch accents are often followed by a type Rh-, for instance nos. 19-21, 113-116, 117-122, 127-132, 149-150. A sequence of sawteeth followed by a type Rh- can frequently be observed in enumerations of facts. As long as a series of facts is not yet finished every group of facts within these series ends with a type Rh- realization. A series finally ends in a type Fl- realization. More type Rh- accents were found in the weather report than in the other excerpts. Accent no. 155 has been classified as type f-/+. But if the next accent is cut off, the accent can be perceived as a type Fnl- realization.
Type Rm- realizations nos. 69 and 90 occur at a boundary and thus do not have a posttonic part. Yet they cannot be classified as type Rø- because the accents cannot be perceived as a neutralization between types Rl- and Rh-: it is perceivable that the accents belong to type Rm-, because a beginning falling movement is perceived.
Differences between accents nos. 33 and 39 (Rm-), on the one hand, and no. 41 (Rh-), on the other hand, are very subtle. In nos. 33 and 39 it can be perceived that pitch in the posttonic part falls slightly, while in no. 41 pitch is retained on the high level.
After accent no. 69, where the reader takes the official report style, there is less variation in intonation than in the first part where he talks freely. In the first part declination is almost absent, while in the second part declination can be observed in the sawteeth.

8.8 Michail Gorbačev

The excerpt was recorded directly from Dutch television. The integral text of Gorbačev's speech "Oktjabr' i perestrojka: revoljucija prodolžaetsja" ("October and *perestrojka*: the revolution continues") was published in the Literaturnaja Gazeta 1987, No. 45, page 3.

Michail Sergeevič Gorbačev, who originates from Groznyj in the northern Caucasus, has some peculiarities in his pronunciation. The genitive plural word ending -ov, in which the grapheme v is regularly pronounced as [f] or [v] by assimilation, frequently occurs in his speech as [o^{u}]. In the genitive singular the ending -ogo, in which the grapheme g in literary pronunciation is realized as [w], Gorbačev produces a [γ].
On the whole Gorbačev's speech in this excerpt is somewhat elated, uplifting, as is usual in official, political speeches.
In the qualification by the native speakers, who of course all recognized Gorbačev's voice, the speech was typified as normal for the given genre, and as very well prepared.

8.8.1 Specification of the phonetic data

In the excerpt of Gorbačev's speech the highest level reached in pitch is 256 hertz, the lowest level is 90 hertz.
The largest excursion, if measured from the lowest level, is 18.1 semitones.
There are 54 pitch accents, 9 of which are additional pitch accents (see below): 45 rising and 9 falling accents.
In this excerpt Gorbačev does not make any hesitations or pauses within utterances.
The excerpt is presented in 10 lines of stylized pitch contours.

type	pitch accent number
Fl-	
Fnl-	
Fl+	23*, 27*, 31*, 33*, 34*, 37*, 45*, 54*
Fnl+	
Fh-	
F^{n}+	
f-/+	19

Table 8.15: Falling pitch accents in Michail Gorbačev

In table 8.16 the features indicate the following values:
- large excursion (R): 13.5 semitones or more;
- normal excursion (r): 13.5 semitones or less.

type	pitch accent number
Rl-	18
Rh-	3, 4, 13, 26, 32, 51
Rø-	9
Rm-	1, 2, 5, 6, 7, 8, 14, 15, 16, 17, 20, 28, 29, 30, 35, 36, 38, 39, 40, 42, 43, 46, 47, 48, 52
Rm+	10, 11, 24, 25
rm-	12, 21, 41, 44, 49, 50, 53
rm+	22
rl-	
rl+	

Table 8.16: Rising pitch accents in Michail Gorbačev

For both table 8.15 and table 8.16 the following subdivision between high and low was found:
- the low level (l): 90 hertz = 0 ST;
- the high level in R (h): 256 hertz = 18.1 ST above 90 hertz;
- the non-low level (nl): 101 (106) hertz = 2 (2.8) ST above 90 hertz;
- the midfield (m): above 101 hertz = above 2.0 ST above 90 hertz;
- the low register (r): 90 - 196 hertz = 0 - 13.5 ST;
- the high register (R): 196 - 256 hertz = 13.5 - 18.1 ST.

8.8.2 Comments on individual pitch accents

If we assume that the text Gorbačev was reading had exactly the same punctuation as in the weekly, the falling pitch accents occur at a punctuation mark, in this case a comma, a dash or a full stop.
Except in no. 27, the falling movements are not steep: 24 to 58 semitones per second.
The excursion at the commas is large (14-17 ST), whereas at the stops the excursion is normal (6-9 ST). *All* the falling pitch accents have late timing. In this case without exception the starting point of the falling movement is near the vowel onset. In some cases there was a high rising part before the fall in the accented vowel: nos. 33, 34, 37 (*blagopolučija, zdorov'ja, razvitija*, respectively).
A *zanos* precedes all type Fl+ accents. Perceptually, the rise in no. 26 has

the effect of a *zanos*: the rise is extended in the next pretonic syllable of the falling no. 27. (See also nos. 9/10 in the Cvetkova excerpt and nos. 21/22, 27/28 in Okudžava.)
Almost all syllables with word stress have a pitch accent. Moreover, additional pitch accents occur, and not only in longer words with more than three syllables. They can be found both in the pretonic and posttonic position and are indicated here in italics:
*rezul'*tate, mo*žet*, dol*žen*, *re*alizovat', vozmož*nos*ti, gumaniz*ma*, *bla*gopolučija, *de*mokratizacija. In the text under the stylized contours in chapter 10 both pitch accents and additional pitch accents are printed in italics. The word stress in these words is indicated with a stress mark. Note that not all additional accents have been indicated, because nearly every utterance in the excerpt shows a zigzag pattern. The cases just mentioned are only a few examples.
Accent no. 37 is almost a rising movement: with a manipulation in which a small plateau is made after the highest point of the rise, the accent can be made to belong to type Rl-. Without a plateau and with a gradual posttonic falling movement the accent would belong to type Rm-. The difference between types Rl- and Fl+ is very subtle here: delaying the beginning of the falling movement by 90 milliseconds (without touching timing) changes the type of accent. This is a very important issue, since the difference between types Rl- and Fl+ has always been a problem in descriptions of Russian intonation (and a stumbling block for foreign students of Russian). In accent no. 37 (in the word *razvitija*) the differences can be illustrated very clearly because of the phonetic features of this accent: large excursion, early timing and a rise and fall in the accented syllable. I have therefore presented the three relevant types of pitch accent one on top of the other in figure 8.1.
In figure 8.1 the solid line indicates the original stylization (Fl+), the dotted line the manipulation into type Rl- and the dashed line the manipulation into type Rm-.
An interesting realization of type Rl- is no. 18 (gumanizma), in which the rise is followed by a falling movement, as usual. But in this posttonic falling movement a *zanos* and an additional pitch accent, a fall, are realized in the posttonic syllable.
As mentioned above, almost all syllables with word stress have a pitch accent. This explains the sometimes rather whimsical form of the pitch contours. Where a sequence of two or more rising pitch accents is realized, a steep fall has to be made in order to make the next rise. Therefore, successive pitch

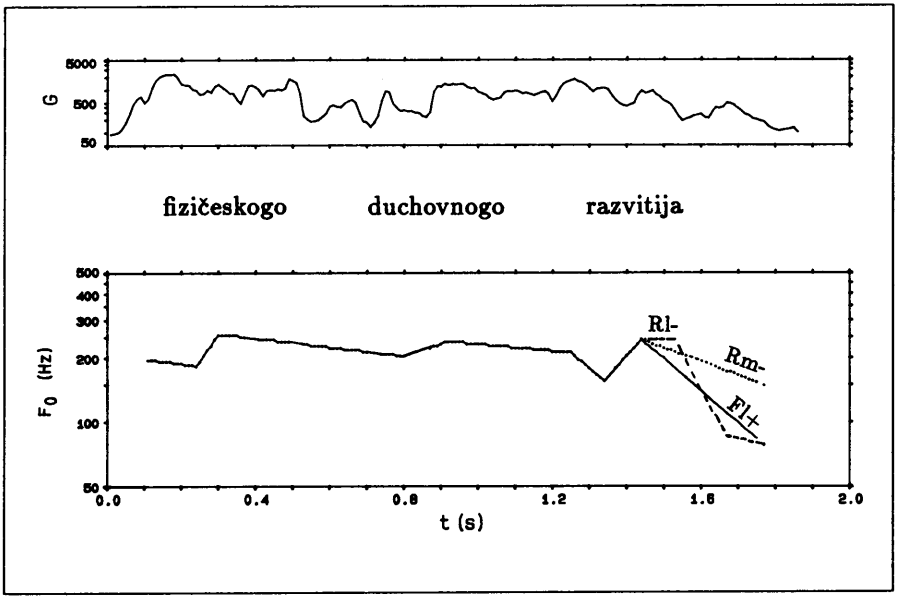

Figure 8.1: Realizations of types Rl-, Rm- and Fl+ one on top of the other

accents are early rises, otherwise there is not time enough to come down for the next rise.

The additional pitch accents contribute considerably to the zigzag contour in, for instance, the first line (nos. 1-9). They are even steeper than the accents in the accented syllables. Elimination of the secondary accents would lead to a regular sawtooth pattern, as in the first part of the next line (nos.10-11). Declination is practically absent. The successive rises and the absence of declination cause the special effect which is characteristic of Gorbačev in his official speeches (and more generally speaking in public, not necessarily political, speeches). Each word is supposed to convey important information (many pitch accents) and the listener's attention should not fade because more is still to come (no declination).

8.9 Bulat Okudžava

The text is from the first chapter, first paragraph of the novel "Bud' zdorov školjar" by Bulat Okudžava. The Russian written text is taken from the Posev edition of 1964: 1-2. The text is spoken by the author of the novel on a

Melodija record. Okudžava is better known for his poetry and especially for the interpretation of his poems. He composes and sings his own songs and accompanies himself on guitar. His style is often compared with the chansons of the late French poet and singer Georges Brassens. This is important background information for understanding the idiosyncrasy of the speaker, as we will see below.
Okudžava's father is Georgian and his mother Armenian. He was educated partly in Moscow, partly in all kinds of different places in the Soviet Union. He has lived in Moscow since his thirties. His pronunciation is not Moscow pronunciation, it is an individual pronunciation. For instance his realization of the [o] as a front vowel is remarkable.
Okudžava sometimes seems to sing his text. Despite his special style, vowel lengthening, singing and other idiosyncratic features, it is possible to describe the pitch accents in the excerpt. In my opinion it is desirable for any spoken Russian text to be covered, as far as the types of pitch accent are concerned, with the overview presented in chapter 6. Obviously, differences in expression based on pronunciation influence the perception of speech, but such differences do not necessarily affect intonation.
The speaker prepared his own written text and performed it without any hesitations or pauses at unexpected places.
The group of native speakers described his speech as typical of that used in reading literature, but criticized his pronunciation, his too frequent rising pitch accents and his sometimes pompous style of speaking. Nobody recognized his voice.

8.9.1 Specification of the phonetic data

In this excerpt the highest level reached in pitch is 232 hertz, the lowest level 75 hertz.
The largest excursion measured from the lowest level is 19.5 semitones.
The excerpt is presented in the stylized pitch contours in 17 lines.
There are 97 pitch accents in the excerpt: 25 falling and 72 rising accents.
In table 8.18 the features indicate the following values:
- large excursion (R): 10 ST or more;
- normal excursion (r): 10 ST or less.

The subdivision of the whole field between high and low was established as follows:
- the low level (l): 75 hertz = 0 ST;

- the high level in R (h): 232 hertz = 19.5 ST above 75 hertz;
- the non-low level (nl): 84 (106) hertz = 2.0 (6.0) ST above 75 hertz;
- the midfield (m): above 84 hertz = above 2.0 ST above 75 hertz;
- high register (R): 134 - 232 Hz = 10 - 19.5 ST;
- low register (r): 75 - 134 Hz = 0 - 10 ST.

type	pitch accent number
Fl-	28, 34
Fnl-	22
Fl+	37, 47, 55, 76, 80
Fnl+	11, 12, 16*, 50, 77, 78, 87, 92
Fh-	
F^n+	
f-/+	31, 32, 33, 43, 59, 60, 68, 75, 79

Table 8.17: Falling pitch accents in Bulat Okudžava

type	pitch accent number
Rl-	35, 86, 88, 91, 93
Rh-	
Rø-	42, 56, 71
Rm-	9, 10, 17, 18, 21, 23, 25, 27, 29, 38, 40, 45, 46, 48, 49, 51, 52, 53, 58, 61, 64, 67, 70, 73, 74, 81, 82, 85, 89, 90, 94
Rm+	1, 2, 4, 6, 8, 14, 15, 24, 95
rm-	7, 54, 62, 63, 65, 66, 72, 83, 84
rm+	3, 5, 13, 19, 20, 26, 30, 36, 39, 41, 44, 69, 96, 97
rl-	
rl+	57

Table 8.18: Rising pitch accents in Bulat Okudžava

8.9.2 Comments on individual pitch accents

In the discussion of Gorbačev's speech it was pointed out that the difference between types Rl- and Fl+ or Fnl+ can be very subtle as regards the phonetic features.
The same can be observed in Okudžava: accents no. 12 and no. 77 have been

classified as type Fnl+, but a manipulation into type Rl- is very easy to make.
The falling pitch accent no. 50 has been classified as *non-low*, despite the fact that the lowest point reached lies below the non-low reference level. It is the late timing and the absence of a posttonic part that makes no. 50 belong to non-low movements.
In the classification experiment (section 4.6) no. 50, with a lowest frequency of 76 hertz (*low*), phonetically has been indicated as similar to no. 16, which has an end frequency of 83 hertz (*non-low*).
Falling accents of type f-/+ sometimes reach the non-low reference level. But these accents cannot be classified as types Fnl- or Fnl+ because of their posttonic part. A rising posttonic part excludes accents from being classified as types Fnl- and Fnl+, which always have a lower, level or no posttonic part.
There is also a linguistic explanation for not classifying these falling accents as type Fnl- or Fnl+, namely the position of the accent in the utterance, but this issue is not discussed in the present study.
In some cases a rise is immediately followed by a falling movement *within* the accented syllable, though the pitch accent is perceived as only rising. The timing is sometimes late, which means that the accented vowel must be fairly long, otherwise there would not be "time" to go down within the accented vowel. The downward movement in these cases is not continued in the posttonic syllable(s). The effect of such a pitch accent is that it almost resembles singing. Singing accents of this type are, for instance, nos. 15, 19, 20, 39. Note that no. 19 is an additional pitch accent.
A small accent after a last accent is, for instance, no. 84. The same type of accent can be found in Cvetkova (no. 68).
Accents nos. 26 and 30 are perceived as type rm+ realizations, but no. 30, which is steeper than no. 26, resembles type Fh-. Yet no. 30 belongs to type rm+ because of the rise immediately at the vowel onset. Note that the perceptual differences between no. 30 and no. 26 are caused by the slope of the rising movement and the begin frequency.
Accents nos. 86 and 88 belong to type Rl-, but not no. 82 which also has a low posttonic part. The difference is the gradual slope in both pretonic and posttonic syllables, and no. 82 has therefore been perceived and classified as type Rm-.
Nos. 56 and 71 have been classified as type Rø- because a prosodic boundary can be heard between these accents and the following syllables. Otherwise, the realization would belong to type Rl-.
As can be concluded from the comments on individual pitch accents, differ-

ences between realizations of different types of pitch accent can be so subtle that pitch accents are sometimes hard to classify in texts like the present one.

I consider the excerpt a dramatic performance rather than a "read-aloud" text for the following reason.
Okudžava repeats the same sequence of pitch accents several times in a way comparable to what in music is called a *phrase*. Pitch accents nos. 1-3 have the same melody as nos. 4-5 and nos. 6-7.
Musical phrases are presented by nos. 13-16 and nos. 17-20; nos. 21-26 and nos. 27-30; nos. 38-39, nos. 40-41 and nos. 42-44; nos. 56-60, nos. 61-63; nos. 64-67, nos. 68-70 and nos. 71-73. In nos. 1-7 and nos. 21-26 the text has a similar syntactic structure, whereas in the other sequences this is not the case.

8.10 Kira Muratova and Vladimir Vysockij

This excerpt was recorded directly from BBC television. The speakers in the dialogue are the film director and actress Kira Muratova and the late famous actor, poet and singer Vladimir Vysockij.
The group of native speakers recognized the dialogue as being taken from a film and typified the speech as normal for the genre, though some natives called the style deliberate, somewhat artificial, but nevertheless typical theatre style; they did not agree about the spontaneity of the speakers. Everybody recognized Vysockij's voice, and some natives recognized from what film the excerpt was taken.
The part in the text about man-eaters is inspired by the novel "Dvenadcat' stul'ev" (The twelve chairs) by Il'f and Petrov. The text ends with a line from a children's rhyme about a little grey goat which was eaten by a wolf and only its horns and hooves were left.
On the fifth page with stylized pitch contours one fragment shows a dashed line instead of a solid line. In the part indicated with the dashes Muratova is whispering.
In order to tell the two speakers apart, in the English translation Kira Muratova's text is printed between brackets in chapter 10. This is not done in the transliteration, because it is clear from the contours who is speaking.
On the cassette this excerpt has been recorded only in the original recording. As can be heard in the original, while speaking the two actors walk about or sigh or make all kinds of noises. The sound quality of some close-copy

stylizations therefore leaves much to be desired. Close-copy stylizations with good sound quality have, however, been used in the perception experiments. Examples from the excerpt have been used in Part I.

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Summary in Dutch

In deze studie wordt een perceptieve beschrijving gegeven van de intonatie in een corpus Russisch (11 sprekers) van ca. 9 minuten spontane spraak en ca. 6 minuten voorgedragen teksten. De studie bestaat uit 2 delen in twee losse boeken: Boek 1 bevat deel I (hoofdstuk 1-6), deel II (hoofdstuk 7-8); deel II wordt vervolgd in Boek 2, dat het corpus bevat in hoofdstuk 9 (teksten) en 10 (gestileerde contouren).

In Boek 1 in het eerste deel wordt na een algemeen overzicht (hoofdstuk 1) de zogenoemde stileringsmethode behandeld (hoofdstuk 2) die gebruikt wordt voor de analyse/resynthese van toonhoogteverschijnselen. Met deze methode, ontwikkeld op het Instituut voor Perceptie Onderzoek (IPO) te Eindhoven, wordt het originele toonhoogteverloop gestileerd tot een minimum aantal rechtelijnstukken (zgn. close-copy stileringen) dat nog melodisch identiek is aan het origineel. Het resultaat is een representatie van intonatie op de meest zuinige wijze, in termen van perceptief relevante toonhoogtebewegingen. De Russische intonatie is niet eerder aangepakt op een met deze methode vergelijkbare wijze. Het kan worden aangetoond dat deze methode, waarbij het perceptief criterium voorop staat, grote mogelijkheden biedt toonhoogteverschijnselen in gesproken taal te onderzoeken. Doordat het resultaat experimenteel verifieerbaar is, zijn de onderzoeksresultaten betrouwbaar.

Er wordt besproken hoe toonhoogtecontouren met behulp van de methode zijn gestileerd en hoe op basis van in het corpus gevonden perceptief relevante toonhoogtebewegingen een classificatie tot stand is gekomen van typen in het Russisch voorkomende toonhoogteaccenten, door deze accenten te sorteren op grond van perceptieve criteria (hoofdstuk 3). In de analyse van het proces van spreken en verstaan is de studie van intonatie niet gebaat bij een overwegend akoestische analyse. Zoals voortdurend is gebleken tijdens het stileren, horen onze oren niet altijd wat de akoestische meting laat zien. Zo kan in het Russisch bijv. een stijgende toon akoestisch gezien op een heel andere plaats in een geaccentueerde syllabe (of ervoor of erna) optreden dan waar wij deze menen te horen. Dit verschijnsel wordt behandeld in hoofdstuk 3 en 5.

In hoofdstuk 4 wordt beschreven hoe in perceptie-experimenten is nagegaan hoeveel typen bewegingen in het Russisch moeten worden onderscheiden en wat de invloed is van bewegingen vóór en na de geaccentueerde syllabe. In twee laatste experimenten is de complete classificatie geverifieerd.
Bij het stileren van Russische intonatie kwamen niet eerder beschreven toonhoogtebewegingen tevoorschijn. Bovendien konden in de literatuur niet duidelijk beschreven verschillen tussen typen toonhoogteaccenten worden onderzocht: de stileringsmethode biedt alle mogelijkheden toonhoogtebewegingen te manipuleren. Bewegingen kunnen groter, kleiner, steiler of geleidelijker worden gemaakt. De plaats van de beweging in de geaccentueerde syllabe kan worden gevarieerd. Al deze aspecten komen waar dit relevant is aan de orde.
In hoofdstuk 5 worden de perceptief relevante kenmerken, die de discreet verschillende typen toonhoogteaccenten in het Russisch definiëren, in detail besproken.
Hoofdstuk 6 geeft een overzicht van typen toonhoogteaccenten, op basis van het corpus, met fonetische specificaties van maximum, minimum en gemiddelde waarden, per spreker en voor alle sprekers samen.
Het tweede deel van de studie bevat het corpus. De notatie van het corpus wordt behandeld in hoofdstuk 7. In een commentaar in hoofdstuk 8 komen sprekerskenmerken en bijzondere of karakteristieke realisaties van toonhoogteaccenten aan de orde.
In Boek 2 staan in hoofdstuk 9 de integrale paralleltekSten van het corpus in het Cyrillisch en in Engelse vertaling.
Tenslotte volgen de gestileerde toonhoogtecontouren van alle geanalyseerde fragmenten uit het corpus in hoofdstuk 10. In de contouren en in de tekst in transliteratie onder de contouren staan de syllaben met toonhoogteaccent gemarkeerd. Bovendien is het type accent aangegeven. Onderaan elke pagina met contouren staat weer de Engelse vertaling. Een cassette met integrale originele opnamen en gestileerde fragmenten is aan de boeken toegevoegd.

Summary in Russian

РЕЗЮМЕ

В данной монографии дается перцептивное описание русской интонации на основе материалов спонтанной (9 минут) и приготовленной (6 минут) речи. Запись производили 11 дикторов.
Исследования по русской интонации в этой книге во многом отличаются от исследований, описанных в богатой литературе на эту тему. Впервые метод перцептивного анализа/ресинтеза, метод стилизования, применяется к русскому языку. До сих пор этот метод использовался только в исследованиях по голландскому, английскому и, в недавнем прошлом, по немецкому языкам.
Аргумент в пользу настоящих исследований - отсутствие перцептивных улик в большинстве монографий по русской интонации. Ожидалось, что используя метод стилизования, будет возможно подходить к проблемам по русской интонации с перспективами на удовлетворительные результаты.
Метод анализа/ресинтеза позволяет экспериментатору сделать слышимыми анализируемые фрагменты речи через ресинтез и сравнить их с оригинальными фрагментами. Кроме того, этот метод имеет большое преимущество, которое заключается в том, что изучаемые проблемы можно представить в аудиовизуальном виде. Эти преимущества выражаются в оформлении данной монографии, которая состоит из двух частей в двух томах с звукоприложением на кассете. В резюме дается краткое изложение метода стилизования и приводится главное содержание десяти глав.

Том 1. Часть 1. Глава 1-6.
Часть 2. Глава 7-8.

Том 2. Часть 2. Глава 9-10.

Том 1. Часть 1.
Глава 1. После краткого введения в первой главе, приводится список употребляемых терминов.
Глава 2. Во второй главе описывается метод стилизования. Этот подход к анализу интонации, известный под названием Нидерландская школа интонации, разработан в Институте восприятия (ИПО) в городе Эйндховен. С помощью метода оригинальная прихотливая высота тона стилизуется и сокращается в терминах прямых линий до возможно минимального числа перцептивно релевантных движений тона без слышимого различия между стилизацией и оригиналом. В результате интонация изображается самым экономным образом в стилизованных контурах, которые, если их озвучить, сохраняют перцептивную идентичность с оригинальными контурами. Перцептивная идентичность является главным критерием настоящего метода.
В общих чертах процесс стилизования проводится следующим образом. В компьютер вводится оригинальная запись и анализируются релевантные параметры. Опираясь на свой слух, экспериментатор сверяет ресинтезированную версию с оригинальной и исправляет возможные ошибки в измерении и в определении глухих и звонких отрезков. Исправленный оригинальный контур служит основой для стилизования. На мониторе изображены частота основного тона на логарифмической шкале, осциллограмма и амплитуда. Передвигая курсор по монитору, экспериментатор устанавливает начало и конец оригинальной кривой и, так сказать, рисует через кривую новую прямую линию. Этот стилизованный таким образом отрезок озвучается и сверяется с оригиналом.
И так стилизуются все кривые, пока не останется перцептивно допустимое, минимальное число прямых линий. Манипулируется только высота тона: амплитуды и осциллограммы остаются не тронутыми.
Как могут прямые линии звучать идентично оригиналу и, более того, естественно, в то время как оригинал представляет из себя кривую? Это кажется невероятным. Однако, ресинтез стилизаций демонстрирует весьма убедительно, что нет перцептивной разницы между "кривой" и "прямой" речью. Звукодемонстрация на кассете свидетельствует об этом. Разумеется, разница в качестве звучания есть.
Стилизации можно озвучить целиком или по фрагментам любой длительности. При этом имеет смысл сравнивать не только короткие стилизованные отрезки с оригиналом, но и звучание этого

отрезка в мелодическом контексте. Сначала экспериментатор анализирует стилизации, а затем носители языка проверяют приемлемость стилизаций в экспериментах по восприятию речи.
Метод дает возможность установить, насколько ударение в высказывании реализовано мелодией. Если при устранении движения тона тем не менее воспринимается акцент в слоге, то этот акцент реализован, очевидно, другими просодическими или лингвистическими признаками (или теми и другими вместе).
Во второй главе также обсуждаются разные релевантные подробности в процессе стилизования именно русских контуров.
Глава 3. В третьей главе обсуждается несоответствие между акустикой и восприятием речи, когда движения тона воспринимаются как реализованные на другом уровне высоты тона, в другом месте речевого сигнала, ближе к началу или ближе к концу слога, чем это показывает акустическая информация.
Приводятся примеры, в которых перцептивно релевантное движение тона акустически находится не в ударном, а в предударном или в заударном слоге, или же в нескольких слогах, в то время как это движение воспринимается как реализованное в ударном слоге. Весьма сильно влияет на восприятие восходящих акцентов заударная часть.
Рассматривается также возможность решения вопроса о перцептивном представлении движений тона, когда акустика не соответствует восприятию.
Когда все материалы стилизованы и установлены мелодические акценты, следующий шаг к описанию интонации - классификация мелодических акцентов в материалах на основе мелодического сходства.
Постоянно сравнивая мелодические акценты друг с другом в течение многих месяцев, я нашла дискретные типы мелодических акцентов, все реализации которых перцептивно эквивалентны.
В третьей главе рассматриваются принципы классификации, понятие "перцептивная эквивалентность" и, детально, первая попытка классифицировать мелодические акценты в одном тексте.
В конце третьей главы дается инвентарь проблем и нерешенных вопросов, возникших при названной классификации. Одна из главных проблем - заударная часть после восходящих акцентов.
Глава 4. В четвертой главе обсуждаются эксперименты по восприятию речи, проведенные на кафедре фонетики ЛГУ. В опытах участвовали

испытуемые с большой практикой в прослушивании, а также наивные слушатели. Большое внимание в экспериментах уделялось названной заударной части в восходящих акцентах: проблеме влияния этой части на восприятие речи было посвящено три опыта.
В одном опыте проверялось восприятие интервала в восходящих акцентах, а также определялось по какому признаку слушатели классифицируют акценты: по величине интервала, по заударной части, или же по обоим признакам.
Другие эксперименты касались остальных проблем классификации восходящих и нисходящих акцентов.
Пользуясь случаем, мне хотелось бы поблагодарить всех испытуемых, которые сидели над трудным заданием и вместе со мной "страдали".
В описании экспериментов широко обсуждаются построение опытов, результаты и выводы. В таблицах дается предварительная классификация восходящих и нисходящих акцентов.
Глава 5. Хотя решены не все проблемы, результаты экспериментов представляются мне достаточным основанием для перцептивного описания русской интонации в общих чертах. Итак, в пятой главе описываются перцептивно релевантные признаки мелодических акцентов в русском языке, на основе классификации и результатов опытов. Различаются следующие признаки:
- экскурсия: настоящий и релятивный размер интервала между начальной и конечной частотой движения тона, выраженной в полутонах;
- регистр: мелодический диапазон говорящего между верхним и нижним уровнями данного говорящего;
- "тайминг": позиция в ударном слоге, где завершается движение тона, ближе к началу (рано) или ближе к концу (поздно) ударного гласного;
- длительность, и крутизна (выражена в полутонах в секунду) движения тона;
- деклинация и инклинация: плавное падение и повышение тона в течение высказывания;
- "рисет": внезапный скачок вверх или вниз в частоте основного тона;
- предударные движения тона и занос;
- заударные движения тона;
- мелодический поворотный пункт между заударной и предударной частями;
- типы мелодических границ: пауза, тишина, колебание.

Каждый признак демонстрируется с приведением примеров на рисунках. Там где обнаружилась компенсация признаков, или влияние одного признака на другой, дается описание этих феноменов. Одно из преимуществ представления высоты тона на логарифмической шкале и выражения размеров движений тона в полутонах состоит в том, что движения тона можно сравнивать друг с другом и тогда, когда они реализованы разными дикторами, то есть независимо от высоты тона в регистре. На основе данных, выраженных в герц, такое перцептивное сравнение исключено.

Глава 6. В заключении первой части монографии, в шестой главе, представлены таблицы типов мелодических акцентов с фонетическими средними данными для отдельных дикторов. Приводятся также средние величины для всех дикторов вместе. Два рисунка изображают на логарифмической шкале типы восходящих и нисходящих мелодических акцентов как результат описанных классификаций, экспериментов и перцептивно релевантных признаков.

Часть 2.

Вторая часть монографии содержит материалы. В седьмой главе дается нотация материалов, в восьмой главе - характеристика всем одиннадцати дикторам: описание голоса, особенности в произношении, особые реализации типов акцентов, а также фонетические данные.

Том 2.

Продолжение второй части.

Во втором томе публикуются материалы. В девятой главе напечатаны полные параллельные тексты оригинальных записей на русском и английском языках, в том числе и те отрезки, которые нельзя было анализировать из-за шума или из-за перебивания говорящими друг друга. В десятой главе изображены интонационные контуры в стилизациях на логарифмической шкале и на одной временной шкале для всех дикторов. Под контурами напечатан русский тескт в транскрипции. И в контуре и в тексте указан ударный слог в слове с мелодическим акцентом. Тип акцента отмечается сразу под текстом. Кроме того, на каждой странице внизу дается английский перевод.

Преимущество издания монографии в двух томах состоит в том, что читатель может, если пожелает, изучать комментарии и кон-

туры одновременно, слушая демонстрации на кассете. Запись оригинальных отрывков на кассете соответствует полным текстам в девятой главе, а запись стилизации - стилизованным контурам в десятой главе.